

**V.3400**  
**User's Guide**

**Motorola  
5000 Bradford Drive  
Huntsville, AL 35805-1993**

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Updates to the products and the manual can be obtained at participating Motorola dealers and distributors, or directly from Motorola.

## **FCC REQUIREMENTS**

This equipment complies with FCC rules Part 68. Located on the equipment is the FCC Registration Number and Ringer Equivalence Number (REN). You must provide this information to the telephone company if requested.

The Registration Number and REN will be inscribed on the printed circuit board on insert cards or on a label attached to either the chassis bottom or metal end-plate on standalone or rack models. In any case the FCC requires these numbers be prominently displayed on an outside surface of the equipment.

The REN is used to determine the number of devices you may legally connect to your telephone line. In most areas, the sum of the REN of all devices connected to one line must not exceed five (5.0). You should contact your telephone company to determine the maximum REN for your calling area.

A variety of Universal Service Ordering Code telephone wall jacks are available for different types of devices or services. Please note that the USOC jack required for this unit is RJ11.

The telephone company may change technical operations or procedures affecting your equipment. You will be notified of changes in advance to give you ample time to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact

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for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been resolved. If your equipment continues to disrupt the network the telephone company may temporarily disconnect service. If this occurs you will be informed of your right to file a complaint with the FCC.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

An FCC compliant telephone cord and modular plug are provided with this equipment, which is designed to connect to the telephone network or premises wiring using a compatible modular jack that is Part 68 compliant. See installation instructions for details.

## **WARNING**

This equipment uses, generates, and can radiate radio frequency energy interfering with radio communications if not installed and used according to the instruction manual. It has been tested and complies with the limits for a Class A computing device according to FCC Rules, Part 15. Operation of this equipment in a residential area may cause interference. If it does, you must correct the cause of the interference.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## **SHIELDED CABLES**

This product has been tested and complies with FCC limits for a Class A computing device. Testing was done with shielded computer cables. Using unshielded cables could cause your system to emit excess radio frequency, increasing the chance of interference. To comply with FCC regulations it is necessary to use shielded computer cables with your installation.

## **SPECIAL REQUIREMENTS FOR CANADA**

Certain requirements exist for data communication products manufactured for use in Canada. Principle among these requirements is the application of the IC label as described below. However, certain data communication products do not require the IC label nor adherence to IC requirements. If this is the case the IC label will not be affixed to the units.

## **INDUSTRY CANADA (IC) REQUIREMENTS**

IC labels are affixed to each unit sold in Canada. This label has the certification number for that particular unit. The numbers are different for each model.

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. IC does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. For their own protection users should ensure that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

## **CAUTION**

Users should not attempt to make installation connections themselves, but should contact the appropriate electric inspection authority or electrician.

## **LOAD NUMBER**

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

## **CANADIAN EMISSION REQUIREMENTS**

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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# **Chapter 1**

## **Introduction**

### **GENERAL**

The Motorola V.3400 series of modems are synchronous, asynchronous, and fax modems that can establish and maintain data communications or facsimile links between a computer at your location, and a remote computer, fax, or Data Terminal Equipment (DTE) located anywhere a standard or cellular telephone can reach. Data transmission can be over standard dial-up, private leased telephone lines, or wireless communication.

The V.3400 series of modems communicate at standard data rates up to 28800 bps with compatible modems connected to similarly equipped computers, computer services, and data bases. Advanced error control and data compression ensure data integrity and increase data throughput.

When used with a Class 1 Fax software package, the modem can exchange fax documents at data rates of up to 14400 bps with any Group 3 fax machine or PC with a fax modem.

A high level security feature allows secure operation of the modem both locally and remotely.

### **FEATURES**

The modem is a flexible telecommunications tool that offers outstanding compatibility and the following standard features:

### **Data Mode**

- Full-duplex operation on 2-wire public, 2-wire or 4-wire private telephone connections with 2-wire public automatic or manual backup
- 300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, and 28800 bps DCE data rates

- Compatible with these standards:  
CCITT V.34  
CCITT V.33  
CCITT V.32 bis  
CCITT V.32  
CCITT V.29  
CCITT V.27  
CCITT V.22 bis  
CCITT V.22  
CCITT V.21  
CCITT V.13  
Bell 212A  
Bell 103  
Plus a variety of software packages
- Synchronous operation at all DCE data rates, and asynchronous operation up to 115200 bps
- CCITT V.42 bis and MNP level 5 data compression
- CCITT V.42 and MNP 4 error control protocol
- LCD configuration and status for easy operation
- Front panel lockout
- Autodial and Autoanswer capability
- Autobaud DTE rate and character format selection
- AT command set
- V.25 bis autodialer
- Configuration memory
- Phone number storage
- Multiple levels of security with auto callback and password protection and up to 50 users
- Automatic speed matching to originating modem
- Remote configuration using command mode or LCD
- Built-in standard diagnostics for testing phone line quality and modems at each end
- 801 auto dial support

- Many user options to support a wide range of operating environments

## **Fax Mode**

- Fax speeds to 14.4 kbps
- HDLC framing to allow T.30 Error Correction Mode
- Standard Class 1 interface conforms to EIA-578
- Group 3 compatibility: CCITT V.21 Channel 2, V.27 ter, V.29, V.17
- Autoanswer under software control
- Automatic fax/data detection

## **COMMUNICATIONS SOFTWARE**

Because software directs the computer and modem to communicate with each other, you will need Mirror III (available from Motorola) or another communications software package for most data mode operations involving the modem. After installing the modem consult the software user's manual for information on the communications software, commands, and features. Software operating commands provide the operator with complete control of the modem.

For operation as a fax modem, a computer and a Class 1 fax software package are required. A fax connection cannot be established except with software control. You will need FaxTalk Plus (available from Motorola) or another Fax communication package.

## **DESCRIPTION**

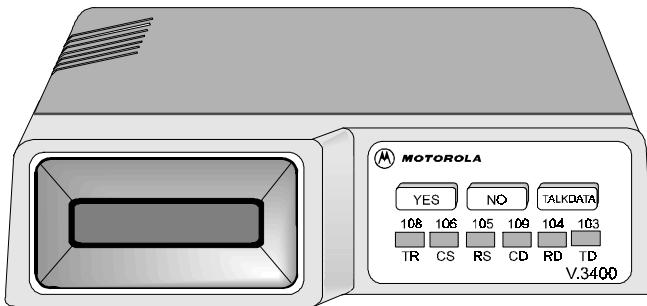
### **Functional**

The V.3400 processes serial asynchronous data from a DTE at all standard rates from 300 bps to 115.2 kbps, and serial synchronous data at rates from 300 to 28.8 kbps. Transmission can be over either dial-up lines or either 2- or 4-wire leased lines. The maximum line speed is 28.8 kbps. Built-in test features can determine system performance and isolate faults in the data link. Operation and configuration are controlled by either the front panel LCD, the AT command set, or the V.25 bis command set.

## **Physical**

The V.3400 has a 32 character LCD front panel with three pushbuttons for option selection (Figure 1-1).

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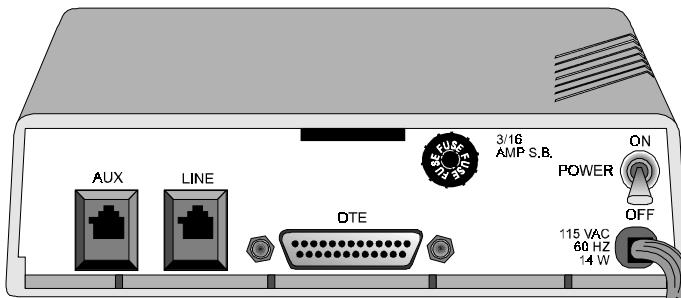


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***Figure 1-1 Typical Front Panel***

The V.3400 rear panel has an EIA-232 DTE connector, an 8-pin AUX jack, an 8-pin LINE jack, the power switch, fuse, and cord (Figure 1-2).

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***Figure 1-2 Rear Panel (115 Vac Model)***

The shelf mount unit has edge connectors that insert into the shelf backplane. The shelf backplane performs the same functions as the stand-alone rear panel.

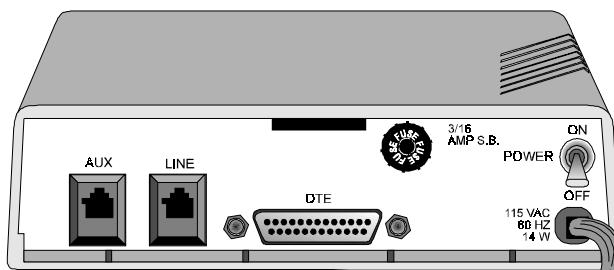
## Chapter 2 Installation

### GENERAL

This chapter provides information for the mechanical and electrical installation of the modem.

### ELECTRICAL INSTALLATION

The rear panel (Figure 2-1) includes connectors for the DTE cable and telephone lines.



*Figure 2-1 Rear Panel Connections*

#### AC Power Connection

Power is supplied through a 6-foot line cord with a grounded 3-wire plug. If common ground is available through the third prong of the plug, a separate ground wire is not required.

#### DC Power Connection



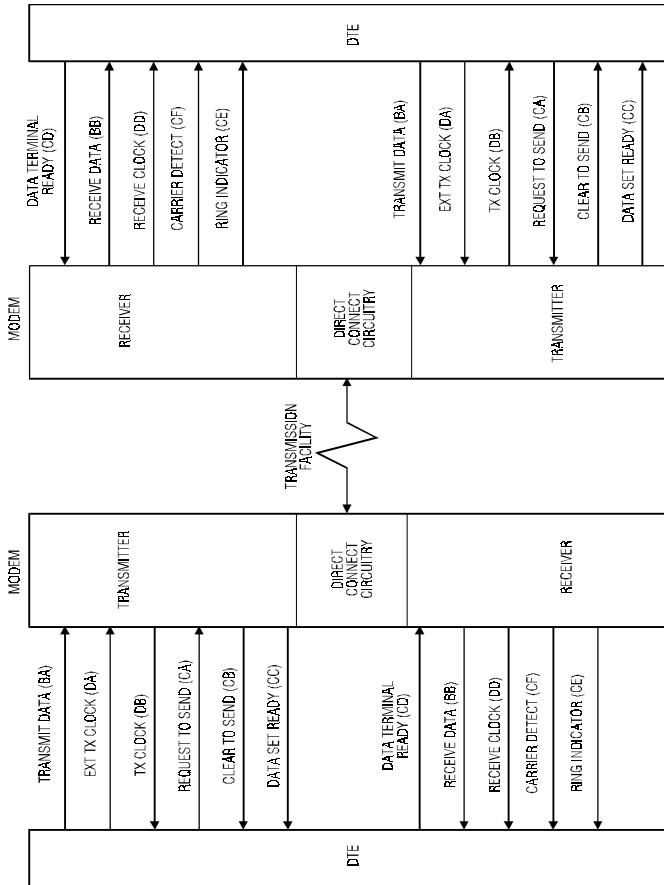
##### Caution

*To protect the DC to DC converter from damage, ensure the positive and negative leads are properly connected.*

If the modem is equipped for dc power input, connect 12 to 60 VDC power to the terminal block attached to the modem back panel. A chassis ground connection is also supplied on the terminal block.

## DTE CONNECTION

The DTE connector is a 25-pin D-series type conforming to EIA-232 specifications. Pin signals are shown in Figure 2-2 and described in Table 2-1.



**Figure 2-2 Digital Interface Signals**

**Table 2-1. Digital Interface Signal Descriptions**

Pin No.	EIA-232D	CCITT V.24	Signal Name	Description
1		101	Shield	No connection
2	BA	103	Transmitted Data	Serial digital data (to be modulated) from a data terminal or other digital data source: Synchronous data must be accompanied by the modem transmit clock (pin 15) or by an external data rate clock (pin 24). Data transitions should occur on positive-going clock transitions; asynchronous data does not require a transmit clock.
3	BB	104	Received Data	Serial digital data output to the DTE interface: Sync data is accompanied by an internal data rate (receive) clock (pin 17) that has positive-going transitions on the data transition. Async data does not require a receive clock.
4	CA	105	Request to Send	A positive level to the modem when data transmission is desired
5	CB	106	Clear to Send	A positive level from the modem in response to Request to Send and when the modem is ready to transmit. *
6	CC	107	Data Set Ready	A positive level from the modem when power is on and ready to operate: In dial-up operation, the modem must be off hook to give a high DSR signal.*
7	AB	102	Signal Ground or Common Return	Common signal and DC power ground
8	CF	109	Received Line Signal Detector	A positive level from the modem indicating the presence of a received signal (carrier detect). *

\* Modem options may force these signals on or cause them to be ignored.

**Table 2-1. Digital Interface Signal Descriptions (Continued)**

Pin No.	EIA-232D	CCITT V.24	Signal Name	Description
9			+12 Volts	+12 voltage reference
10			-12 Volts	-12 voltage reference
11			Signal Quality Indicator	This circuit indicates probability of errors in the received data: a positive level indicates poor signal quality while a negative level indicates good signal quality. †
15	DB	114	Transmit Clock (DCE)	A transmit data rate clock output for use by an external data source: Positive clock transitions correspond to data transitions.
17	DD	115	Receive Clock	A receive data rate clock output for use by an external data sink: Positive clock transitions correspond to data transitions.
18		141	Local Loopback (Loop 3) Control	A positive level causes the modem to enter the local analog loopback test mode.*
20	CD	108.2	Data Terminal Ready	This circuit is positive when the DTE is ready to originate or answer a call in dial-up operation. DTR must always be active (high) in 2-wire private line operation. Cycling DTR causes retraining.*
21		140	Remote Digital Loopback	A positive level causes a digital loopback test mode at the remote modem.*
22	CE	125	Ring Indicator	In direct dial operation this circuit is positive in response to an incoming ring signal.*
23	CH	111	Data Rate Select	Supplies a data rate control input to select primary or fallback data rate: Negative voltage selects primary data rate and positive voltage selects fallback data rate.*

\* Modem options may force these signals on or cause them to be ignored.

† This function can be disabled or its logic sense reversed by hardware straps.

Refer to Strap Options.

**Table 2-1. Digital Interface Signal Descriptions (Continued)**

Pin No.	EIA-232D	CCITT V.24	Signal Name	Description
24	DA	113	External Transmit Clock	A serial data rate clock input from the data source. Positive clock transitions correspond to data transitions.
25		142	Test Mode	Indicates the modem is in a test mode

## TELEPHONE LINE CONNECTION

The modem operates in one of three line-related modes:

- Permissive (PSTN)
- Programmable (PSTN)
- Private line

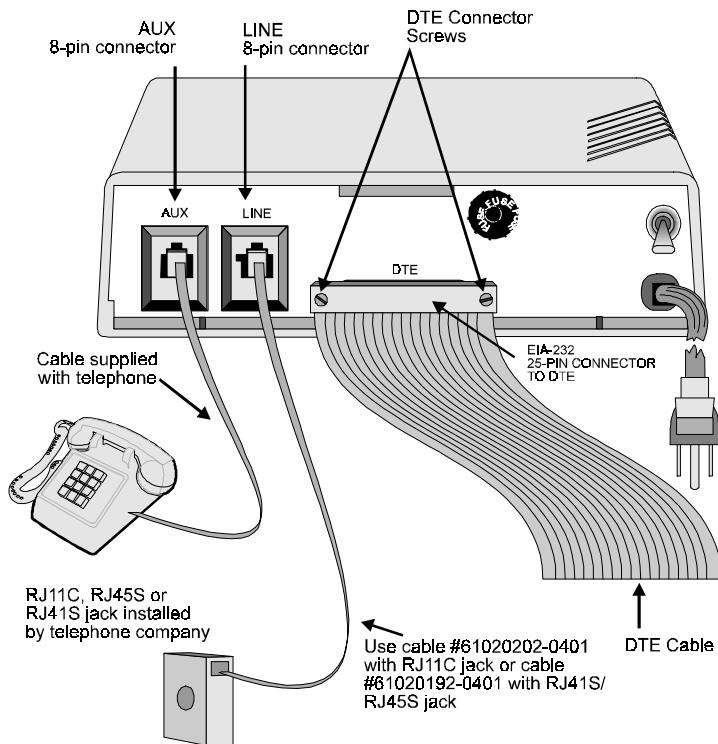
Permissive and programmable modes are used on the Public Switched Telephone Network (PSTN). Private line mode is used on 4-wire or 2-wire leased lines. The user must decide which mode to use and then select the telephone jack arrangement.

### PSTN Connection

Modems are registered with the Federal Communications Commission (FCC) for direct connection to the PSTN (dial-up network). The label on the chassis bottom gives the FCC registration number and other information required for network operation.

Direct connection to the PSTN provides two modes of operation (Figure 2-3):

- Permissive (standard domestic or home use)
- Programmable



**Notes:**

1. The AUX jack is provided on the back of the modem for use with a standard rotary or tone dial telephone regardless of the telephone jack arrangement ordered from the telephone company.
2. This standard rotary or tone dial telephone set can be used for originating a call or for voice communication. For sites requiring only autoanswer capability, a phone is not needed.

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**Figure 2-3 Dial-up Connection**

### **Permissive**

In permissive mode, the modem transmits a maximum signal level of -9 dBm. Signal loss between the modem and telephone company central office is not controlled.

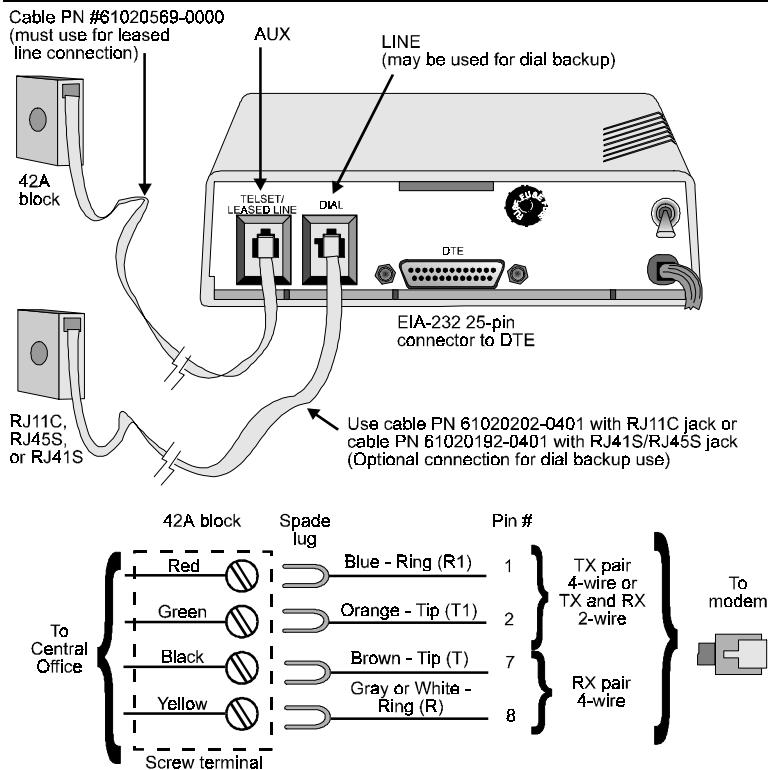
### **Programmable**

Programmable mode corrects for the signal level loss between the modem and the telephone company central office. This is done by setting the modem transmit output signal level with a fixed-value programming resistor selected and installed in the jack by the telephone company. This allows the output signal to reach the central office at the optimum level of -12 dBm. Jack arrangements for this mode are the RJ45S (Programmable) and RJ41S (Universal). The RJ41S has a switch option that must be selected to Programmed (P). Cable PN 61020192-0401 is used to connect the LINE jack on the back of the modem to the RJ41S or RJ45S wall jack.

### **Leased Line Connection**

Leased lines use either a 2-wire or 4-wire connection. The telephone company will install the leased line and wall jack at your site. The line connects to the modem at the 8-position AUX jack.

Figure 2-4 illustrates the typical hook-up of the modem for operation over private leased lines with dial backup.



**Notes:**

1. Set the transmit output level to 0 dBm.
2. DTR, which is the signal on pin 20 of the DTE interface, must be active or the option DTE IGNORED must be set for 2-wire OR 4-wire leased line operation.
3. The connection shown includes dial backup. Connect only the 42A block to the AUX jack for regular leased line use.

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**Figure 2-4 Leased Line Connection**

## **Chapter 3**

# **Getting Started**

### **OPTION SELECTION**

There are six ways to change or select options:

- LCD - Using the front panel LCD and pushbuttons is simple, straightforward, and requires the least amount of technical background. Chapter 4 explains LCD operation.
- AT Commands - The AT compatible command set can be used to select modem options. Chapter 5 describes AT commands.
- V.25 bis Commands - An extended set of V.25 commands allows selection of modem options during synchronous operation. Refer to Chapter 11.
- Status Registers - A series of special ATS commands allows the operator to change the decimal or hexadecimal value of a memory byte to change one or more options in that byte. Chapter 10 describes S-registers.
- Single Bit Status Registers - A second series of special ATS commands allows the user to change single bits within a byte to change an option. Chapter 10 explains single bit control.
- Software program - A wide variety of software programs are available, or advanced computer users can write their own software programs to interact with the modem. This manual does not discuss software programs.

### **POWERUP**

A powerup procedure is not required. Turn the ON/OFF power switch on the rear panel to ON. The modem is factory configured to operate in most public switched telephone applications. If a user has stored a desired option set it will be automatically be restored at power up.

## **PLACING A CALL**

### **Using a Standard Telephone**

1. Lift the telephone receiver. Wait for the dial tone.
2. Dial the number of the remote site.
3. When the answer back tone is heard, immediately press the TALK/DATA button and hang up the telephone. The modems go through a connection sequence and establish a data link. If a data link is not established, return to the first step.
4. After the link is established, hang up the telephone.

### **Autodial from Front Panel**

1. If no number to dial is stored yet advance to Main Menu #6, CHANGE PHONE NUMBER.
2. Enter the number using NO to scroll and YES to select.
3. When number is entered press YES to store the number.
4. Advance the LCD to main #2, DIAL STORED NUMBER.
5. Select number to dial and press YES to dial. After dialing the modems follow the same procedure as when using a standard telephone.

### **Autodial from a Terminal with the AT Command Set**

To dial a number, for example 555-1212, type *ATD 555-1212* and press Enter, or enter *ATDSn* where *n* equals the stored telephone number location 1-9 to dial.

The modem dials the number — either pulse or tone, whichever is currently in effect — and takes the role of the originate modem.

Refer to Dial Commands section in Chapter 5 for additional dialing commands.

## **ANSWERING A CALL**

### **Autoanswer**

Normally the modem is configured to autoanswer on the first ring. A telephone plugged into the AUX jack will also ring.

### **Manual Answer**

On ring detection the modem LCD displays ringing status.

Press TALK/DATA to answer the call and place the modem in the data mode.

### **Answer from Terminal with AT Command Set.**

The modem displays the ring response.

To answer an incoming call type *ATA*. The modem begins sending an answer back tone and attempts to connect to the remote modem.

## **ENDING A CALL**

### **Call Termination from Front Panel**

1. Press TALK/DATA and DO YOU WANT TO DISCONNECT will be displayed.
2. Answer YES.

### **Call Termination from Terminal with AT Command Set**

1. Enter *+++* and the modem will enter command mode.
2. Enter *ATH* and the modem will terminate the call.

### **Reasons for Call Termination**

The following conditions cause call termination.

<b>Condition</b>	<b>Description</b>
Abort Disconnect (No answer, busy signal, no modem, etc.)	Default 30 sec; select 1 to 255 sec (S-register 7)
ATH	Disconnect command
Loss of Carrier Disconnect	Select 100 ms to 25.5 sec (S-register 10)
Receive Long Space Disconnect	Disabled or select 2 sec
DTR Disconnect	Disabled or select 10 ms to 2.55 sec (S-register 25)
Loss of Line Current	
Cleardown	A disconnect method used in V.32 and V.34 mode.
LCD Display	When TALK/DATA is pressed, the LCD displays DO YOU WANT TO GO TO TALK? When YES is pressed modem hangs up, if no telephone is con- nected or if the connected telephone is not off hook. Pressing NO displays DO YOU WANT TO DISCONNECT? Press YES to disconnect.
Train Timeout	Modem fails to establish communication with remote site. Default is 30 seconds (S-register 7)
Protocol Link Establishment Failure	Reliable mode only; failure to establish reliable link
Inactivity Timeout	Default is 0 or disabled; select for disabled or 1 to 255 minutes (S-register 8)
Protocol Retry Limit Exceeded	12 retransmissions of the frame
Minimum DCE Speed	A connection occurred at a rate less than minimum
Security Password Failure	Maximum password entry attempts exceeded
Security Callback	Security callback is enabled and a new remote con- nection is established. The modem disconnects and places a call to the programmed number
Signal Quality	Leased line operation with dial backup enabled; extended loss of carrier or 4 unsuccessful retrains in 3 minutes cause dial backup
Test Mode entered	Certain test modes require call termination
Modem power is turned off.	

## **Chapter 4**

# **Front Panel Operation**

### **GENERAL**

The function of the LCD front panel is to provide easy real-time access to modem configuration and status. The LCD can be used at any time to modify modem options or obtain information about modem operation and status. All of the major options of the modem can be controlled through the LCD interface without an external terminal or phone line connection. Operation of the LCD can be secured using a password protection feature. A remote modem can even be configured using the local LCD through the use of the front panel remote configuration feature.

### **LED DESCRIPTIONS**

The V.3400 has six LED indicators: TR, CS, RS, CD, RD, and TD. The functions of these LEDs are as follows:

**TR** - Terminal Ready. This LED lights when the DTE asserts Data Terminal Ready. This signal is input on pin 20 (CCITT V.24/108.2).

**CS** - Clear to Send. This LED lights when the modem is ready to send data to the DTE. This signal is output on pin 5 (CCITT V.24/106).

**RS** - Request to Send. This LED lights when the DTE is ready to send data to the modem. This signal is input on pin 4 (CCITT V.24/105).

**CD** - Carrier Detect. This LED lights when the received audio carrier signal is detected or, if enabled, when error control protocol negotiation is complete. This signal is output on pin 8 (CCITT V.24/109).

**RD** - Received Data. This LED lights for a data space condition at the receive data output, indicating receive data output activity. This signal is output on pin 3 (CCITT V.24/104).

**TD** - Transmit Data. This LED lights for a data space condition at the transmit data input, indicating transmit data input activity. This signal is input on pin 2 (CCITT V.24/103).

## **LCD MENUS**

The V.3400 has seven main LCD menus that support modem operations. Table 4-1 lists them in the following sequence:

- MODEM STATUS
- DIAL STORED NUMBER
- DISPLAY STATUS
- SELECT TEST
- MODIFY CONFIGURATION
- CHANGE PHONE NUMBERS
- FRONT PANEL FEATURES

## **LCD MENU OPERATION**

The LCD menu is portrayed by a six column table (Table 4-1). The first column lists the seven main menu categories. The second column is the submenus, listing functions for each category in the main menu. The third column lists specific items for submenu functions. The fourth column lists option choices or status for the specific items in the third column. The fifth and sixth columns in the table show associated AT commands and S-registers as a cross reference.

Each column item has a corresponding header in the previous column. If an option setting is selected or if all settings have been scrolled through, the display will return to that header.

Because of the menu structure and option choices not all main menus use all four columns in Table 4-1. However, option selection and sequence are the same.

In general, while operating in the option menu, pressing NO scrolls vertically down the columns and pressing YES advances horizontally across the columns. However, responding to the LCD prompt is the best method to reach an option.

If the NO pushbutton is pressed and held, the LCD scrolls through the menus.

Press the TALK/DATA button to return to the previous menu.

**Table 4-1. Menu Options**

MAIN MENU		LCD MESSAGES				S-REG
1	MODEM STATUS	V.34 28800 IDLE <i>Note: Shows the current modulation, bit rate, and modem status.</i>		(Press NO to advance to MAIN 2)		S91 S67
MAIN MENU		SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
2	DIAL STORED NUMBER?		DIAL #1-9	YES, NO	DSn (n-1-9)	---
3	DISPLAY STATUS? <i>(status only)</i>	DTE SIGNALS	QM ON/OFF DSR ON/OFF OH ON/OFF RI ON/OFF	DISPLAY STATUS	---	---
		PROTOCOL*	NONE MNP 2, 3, 4, or 5 LAPM	DISPLAY STATUS	---	---
		COMPRES-SOR*	NONE MNP 5, V.42b	DISPLAY STATUS	---	---
		CARRIER DESCRIPTIONS*	RECEIVE LEVEL NEAR END ECHO LEVEL FAR END ECHO LEVEL FAR END ECHO DELAY FREQUENCY TRANSLATION BAUD RATE RX BIT RATE TX BIT RATE	DISPLAY STATUS	---	---
		LAST DISCONNECT REASON	DISPLAY STATUS		I5	
		(Offline test only)	LOCAL ANALOG LOOP	INITIATE, EXIT	&T1	S16
			LOCAL ANALOG LOOP WITH TP	INITIATE, EXIT	&T8	S16

\* When modem is not online, the display flashes and shows the status from the last connection.

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
4 c o n t. 5	(Online test) MODIFY CONFIGURATION?	LOCAL DIGITAL LOOP †	INITIATE, EXIT	&T3	S16
		REMOTE DIGITAL LOOP †	INITIATE, EXIT	&T6	S16
		REMOTE DIGITAL LOOP WITH TP †	INITIATE, EXIT	&T7	S16
		TEST PATTERN†	INITIATE, EXIT	% T	---
	CHANGE MODEM OPTIONS?	CHANGE LEASED/DIAL LINE?	2 WIRE/ 4 WIRE	&L1, &L	S27
		CHANGE MODULATION?	AUTOMODE V.21 BELL 103 B212A V.22 bis V.27 ter * V.29 * V.33 * V.32bis V.34	*MM *MM1 *MM2 *MM4 *MM5 *MM6 *MM8 *MM10 *MM11 *MM12	S88
		CHANGE MAX DCE RATE?	28800 26400 24000 21600 19200 16800 14400 12000 7200 9600 9600U 4800 2400 1200 300 DTE SPEED	%B15 %B14 %B13 %B12 %B11 %B10 %B9 %B8 %B7 %B6 %B5 %B4 %B3 %B2 %B1 %B	S69

† Modem must be online with protocols disabled

\* Lease line only

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
5 c o n t. MODIFY CONFIGU- RATION? (continued)	CHANGE MODEM OPTIONS? (continued)	CHANGE MIN DCE RATE?	28800 26400 24000 21600 19200 16800 14400 12000 7200 9600 9600U 4800 2400 1200 DISABLED DISABLED	%L15 %L14 %L13 %L12 %L11 %L10 %L9 %L8 %L7 %L6 %L5 %L4 %L3 %L2 %L1 %L	S69
		CHANGE V.34 RATE THRESH- OLD?	LOW BER MED BER HIGH BER	*TH *TH1 *TH2	---
		V.34 ASYM RATES	ENABLE DISABLE	*AS1 *AS	S96
		NORMAL ORIGINATE FORCED ANSWER*	NORMAL ORIG. FORCED ANS.	*OR *OR1	S14
		V.22 GUARD TONE	DISABLE 550 Hz 1800 Hz	&G &G1 &G2	S23
		V.32 FAST TRAIN	ENABLE DISABLE	*FT1 *FT	S29
		SQ RETRAIN	ENABLE DISABLE	%E1 %E	S60
		SQ AUTO RATE	HIGH BER MED BER LOW BER DISABLED	%R3 %R2 %R1 %R	S53
		TRANSMIT CLOCK SELECT	INTERNAL EXTERNAL RECEIVE	&X &X1 &X2	S27

\* Lease line only

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
5 c o n t. MODIFY CONFIGU- RATION? (continued)	CHANGE MODEM OPTIONS? (continued)	DIAL LINE JACK †	PER - RJ11 PROG - RJ15	%Z %Z1	S51
		DIAL TRANSMIT LEVEL	-9 dBm to -21 dBm	*TDn	S51
		LEASE TRANSMIT LEVEL*	0 to -21 dBm	*TLn	S52
		LINE CURRENT DISCONNECT †	OFF SHORT LONG	*LC, *LC1, *LC2	S32
		LONG SPACE DISCONNECT †	ENABLE DISABLE	Y1 Y	S21
		DIAL BACKUP*	MANUAL AUTO- MATIC	*DB *DB1	S32
		LOOKBACK TIME*	0 DISABLED to 255 MINUTES	---	S28
	CHANGE PROTOCOL OPTIONS?	LAPM PROTOCOL	ENABLE DISABLE	\N4,\N5, \N6,\N7 \N,\N1, \N2,\N3	S70
		MNP PROTOCOL	ENABLE DISABLE	\N2,\N3, \N6,\N7 \N,\N1, \N4,\N5	S70
		PROTOCOL FALLBACK	ENABLE DISABLE	\N3,\N5, \N6,\N7 \N,\N1, \N2,\N4	S70
		DATA COMPRES- SION	DISABLE NORM TX RX	%C %C1 %C2 %C3	S56
		DTE SPEED	DTE=DCE CONSTANT DTE	J1 J	S70

\* Lease Line only

† Dial Line only

‡ Dial Line only

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
5 c o n t. MODIFY CONFIGU- RATION? (continued)	CHANGE PROTOCOL OPTIONS? (continued)	DTE FLOW CONTROL	DISABLE XON/XOFF CTS RTS/CTS	\Q \Q1 \Q2 \Q3	S54
		DCE FLOW CON- TROL	DISABLE XON/XOFF CTS	\Q4 \Q5 \Q6, \Q7	S54
		XON/XOFF PASS THROUGH	ENABLE DISABLE	\X1 \X	S54
		INACTIVITY TIMER	OFF, 15, 30, 45, 60, 75, 90 MIN	\TLn	S58
		BREAK CONTROL	0, 1, 2, 3, 4, 5	\K, \K1, \K2, \K3, \K4, \K5	S59
		V.42 FAST DETECT	ENABLE DISABLE	\M1 \M	S70
	CHANGE DTE OPTIONS?	OPERATION	SYNC ASYNC	&M1, 2, 3, 4, 5, 6 &M	S27 S30
		DTE RATE (Async)	300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 38400, 21600, 24000, 26400, 28800, 57600, 115200	---	S80
		CHAR SIZE (Async)	7 BIT 8 BIT	---	S61
		PARITY (Async)	NO, EVEN, ODD	---	S61

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
5 c o n t.	MODIFY CONFIGU- RATION? (continued)	CHANGE DTE OPTIONS?	DIAL METHOD  ASYNC DTR, MANUAL, V.25 BISYNC, V.25 SDLC V.25 bis async	&M1,&M 2 &M3 &M4 &M5 &M6	S27 S30
		AT COMMAND SET	ENABLE DISABLE	*NT1 *NT	S29
		CHARACTER TYPE (V.25 only)	ASCII, EBCDIC	---	S30
		SDLC DATA FOR- MAT	NRZ, NRZI	---	S30
		DTR STATE	IGNORE RECALL CMD DISCON- NECT RESET	&D &D1 &D2 &D3	S21
		DSR STATE	NORMAL FORCED HIGH OFF 5 SEC ON DISCON- NECT FOLLOWS OH	&S1 &S &S2 &S3	S21
		DCD STATE	NORMAL FORCED HIGH OFF 5 SEC ON DISCON- NECT FOLLOWS REMOTE RTS	&C1 &C &C2 &C3	S21

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG	
5 c o n t.	MODIFY CONFIGURATION? (continued)	CHANGE DTE OPTIONS? (continued)	CTS STATE	NORMAL FORCED HIGH CTS FOL- LOWS DCD CTS=RTS	&R &R1 &R2 &R9	S21 S72
		RTS/CTS DELAY	0 to 150 ms (10 ms)	---	S26	
		DTE COM- MANDED Fallback	ENABLE DISABLE	*FB1 *FB	S53	
		OPTIONS RES/ RETND AT DISC	RESTORED RETAINED	*RO1 *RO	S29	
	CHANGE TEST OPTIONS?	BILATERAL DIGITAL LOOP	ENABLE DISABLE	*DG1 DG	S34	
		DTE LOCAL TEST	ENABLE DISABLE	*LA1 *LA	S34	
		DTE REMOTE TEST	ENABLE DISABLE	*RD1, *RD	S34	
		REMOTE COM- MANDED	ENABLE DISABLE	&T4 &T5	S23	
		TEST TIMEOUT	OFF, 60, 120, 180, 240 SEC	---	S18	
	CHANGE DIAL OPTIONS?	DIAL TYPE	PULSE, TONE	P, T	S14	
		AUTODIAL #	OFF, 1 - 9	*AU <sub>n</sub> (n=1-9)	---	
		DIAL TONE	BLIND DIAL WAIT FOR DIAL TONE	X, X1, X3 X2, X4	S22	
		WAIT DELAY (Blind Dial)	1, 2, 3, 4, 8, 16, 32 SEC	---	S6	
		PAUSE DELAY	1, 2, 3, 4, 8, 16, 32 SEC	---	S8	
		CALL TIMEOUT	15, 30, 45, 60, 75, 90, 105, 120 SEC	---	S7	

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
5 c o n t.  MODIFY CONFIGU- RATION? (continued)	CHANGE DIAL OPTIONS? (continued)	ANSWER RING #X	1, 2, 4, 8, 16	---	S0
		AUTOCALLBACK	ENABLE, DISABLE	---	S72
	CHANGE SPEAKER OPERATION?	VOLUME CONTROL	LOW MEDIUM HIGH	L1 L2 L3	S22
		SPEAKER CONTROL	ON UNTIL CARR DETECT ALWAYS ON OFF WHILE DIALING ALWAYS OFF	M1 M2 M3 M	S22
	LOAD/STORE OPTION SET?	LOAD FACTORY OPTION	NO, 1-9	&Fn (n=1-9)	---
		LOAD USER OPTION SET	1 2	Z0 Z1	---
		STORE PRESENT OPTIONS	1 2	&W &W1	---
		USER OPTION AT RESET	1 2	&Y &Y1	---
6	CHANGE PHONE NUMBERS?	PHONE NUMBER	ENTER NUMBER 32 digits	&Zn (n= phone # and modi- fiers) *CNn,x	---
7	FRONT PANEL FEATURES?	CHANGE RMT PASSWORD?	ENTER PASSWORD	%P	---
		ENTER REMOTE CONFIGURATION	ENTER REM CFG PASSWORD	%T	---
		EXIT REMOTE CONFIGURATION	EXIT	&T	---

**Table 4-1. Menu Options (Continued)**

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM.	S-REG
7 c o n t. FRONT PANEL FEATURES? (continued)		CHANGE FRONT PANEL PASSWORD	ENTER PASSWORD *	---	---
			ACTIVATE SECURITY		

\* Password of 0000 disables front panel security.

## FRONT PANEL SECURITY

The Front Panel Security feature provides password protection for front panel menu access. The modem is shipped from the factory with this feature disabled.

The Front Panel Security password is a 4-digit string that can be set to any combination of digits from "0000" to "9999". Selecting a password of "0000" disables Front Panel Security; any other password enables it.

When this feature is enabled there are two ways it may be activated. It may be explicitly activated via a front panel screen under Main Menu #7, or the modem will activate it when no front panel buttons have been pressed for 3 minutes. When Front Panel Security is activated, the front panel menu will return to Main Menu #1 and the front panel will become secured.

While in this secured state, the Main Menu #1 screen continues to maintain modem status, but a password must be entered before other front panel screens may be accessed. Pressing any front panel button causes the modem to prompt for the front panel password. After the password has been entered, a message briefly displays the result of the password validation process and, depending on the result, Front Panel Security either becomes inactive or returns to its active state.

During password entry, the front panel buttons are interpreted as follows:

- |    |   |
|----|---|
| NO | Pressing the NO button causes the character at the cursor to change to the next valid password character. |
|----|---|

- |           |  |
|-----------|--|
| YES       | Pressing the YES button while the cursor is on any of the first three password characters causes the cursor to advance to the next password character. When the cursor is on the last password character, pressing the YES button causes the modem to accept the displayed password. |
| TALK/DATA | Pressing the TALK/DATA button while the cursor is on the first password character causes the password entry to be aborted. When the cursor is on any other character, this button causes the cursor to move to the first password character.   |

## **Chapter 5**

# **AT Commands**

### **GENERAL**

This chapter describes commands used to select options and to operate the modem. Some options depend on or are restricted by the mode of operation.

### **COMMAND CATEGORIES**

The modem offers eight major categories of command statements:

- Response
- Dial
- Answer
- Terminal Interface
- General
- Private Line
- Configuration
- Remote Configuration

Six other groups of AT commands are discussed in their respective chapters:

- Protocol
- Test
- Security
- Fax
- S-registers

### **OPERATION MODES**

During asynchronous operation the modem functions in one of three modes:

- Offline Command Mode
- Online Command Mode
- Data Mode

### **Offline Command Mode**

In offline command mode (generally referred to as command mode), the modem communicates with the computer or terminal. Commands can be entered separately or in strings. There is no data communication link established in this mode.

### **Online Command Mode**

This mode is entered from the data mode after the escape command has been entered. The escape command is performed by entering the escape character (+ is the default) three times. The data communication link remains established but data transmission is suspended. The modem will now accept commands like it does in the offline command mode.

### **Data Mode**

The modem goes to data mode (online) after it acknowledges the proper signal and successfully connects with a compatible modem. In data mode, the modem sends and receives data, but will not accept or execute command instructions.

Example: The modem is in the command state. The *D* command and phone number are used to dial a remote modem. The local modem waits to receive an answer back tone from the remote modem. When the local modem receives the carrier, it leaves the command state and goes online in the data mode. At this time, both modems are using the telephone line and a communication link is established.

## **SENDING COMMANDS TO THE MODEM**

When the computer, modem, and monitor are on, an instruction can be sent to the modem telling it what function or activity to perform. The instruction, called a command statement, command string, or just command, is typed using the computer/terminal keyboard. The command statement temporarily resides in a section of memory called the command buffer.

Each command statement is made up of characters, numbers, and such keyboard symbols as the & and % signs. Commands must be written in a specific form so the modem recognizes and follows the instruction.

## **Creating a Command Statement AT**

To create a command statement use the following steps:

- Type *AT*. This is the Attention Code telling the unit a command statement follows.
- Type the command.
- Press the Enter key to send the command statement to the modem.

An example of a command statement using the dial command (*D*) follows.

ATD554-1212

This statement can be read as

Attention: Dial 554-1212.

Another AT command statement example is

ATZ

This statement can be read as

Attention: execute the Z command.

After entering a command line the modem returns a response message indicating whether or not the command was accepted or giving the data requested by the command line.

To clear command statements from the buffer you can either

- Turn the modem off,
- Enter *AT*, or
- Use the DTR reset feature.

## **Autobaud**

The attention code (AT) is analyzed by the modem to determine the transmission speed, parity, and bits per character used by the DTE. This autobaud process is repeated each time the AT command prefix is sent.

## **Guidelines for Creating Command Statements**

When typing command statements, note the following:

The attention code (AT) may be upper or lower case but not a combination like aT.

- Press the Enter key to execute a command.
- The command buffer can hold 80 characters.
- Use the backspace or delete key to erase the last character.

Even though the initial AT code must be all upper or lower case, characters that follow can be any mix of upper and lower case.

## **Monitor Display**

As commands are typed they appear on the monitor so the operator can verify the input. This is called local character echo. The echo may be turned on or off using AT commands. Refer to *Local Character Echo* in the *General Commands* section of this chapter for details.

## **Command Statement Buffer**

The modem temporarily stores up to 80 characters in the command buffer. If this limit is exceeded, the modem does not accept the command and sends an ERROR message. To correct this condition, retype the command using 80 characters or less.

The AT characters and punctuation used in telephone numbers do not take up space in the buffer. Also, blank characters used as spaces to help increase readability are not counted. For example, the modem reads the commands

```
ATD (212) 554-1212  
ATD2125551212  
ATD 212 555 1212
```

as having 11 characters each. Commands can be typed in any of these forms.

## **Backspace Key**

Use the backspace key to change the command statement or correct errors. The backspace key allows the cursor to be moved back to the character(s) in error. The command can then be retyped from that point.

Example: *ATD5551211* has been typed. To change the last *1* to *2*, press the Backspace key once, type *2*, and press Enter to execute the command.

## **Repeating a Command A/**

This command tells the computer to repeat the last command stored in its buffer. It automatically reexecutes the command without retyping. The return key does not need to be pressed.

Example: The *ATD5551212* command has been executed, and the phone is busy. To repeat the instruction type *A/*. Do not use AT before this command as AT empties the buffer and there would be no command to repeat.

## **Numbered Commands**

Series of commands that start with the same letter are distinguished by a number following the letter.

For example, the *M0* command selects speaker always off, *M1* speaker on until carrier detected, and *M2* selects speaker always on.

In all cases, the zero (0) may be omitted so the commands *M* and *M0* are identical. For clarity, this manual uses the nonzero form of commands. The modem treats both the same but zeros count against the buffer total.

## **Group Commands**

A group of commands can be typed in a single command statement. Pressing the Enter key sends the entire command string to the modem, which executes each command individually in the order it appears in the command statement reading from left to right.

For example, the command statement *ATQ0V0L3DT5551212* means

- *AT* Attention.
- *Q* Allow response messages to be sent.
- *V* Select digit code responses.
- *L3* Select high volume.
- *DT* Tone dial 555-1212.

The modem executes the AT command followed by the *Q*, *V*, *L*, *D*, and *T* commands. *ATQ0V0L3DT5551212* can be read as *ATQVL3DT5551212*. Eliminating zeros reduces the number of characters, allowing more room in the buffer.

The dial *D* command initiates the dial process so no other commands, only dial modifiers, can follow it.

## **RESPONSE COMMANDS**

The modem communicates with the operator through response messages. These appear on the monitor or a computer printout to show the result of the command or action executed. Response messages can appear as words or numbers.

### **Digit / Word Selection V**

The *V* command tells the modem which type of response message to show on the monitor. Some software requires digit response messages but words are easier to remember.

Command	Operation
V	Enables digit response messages
V1	Enables word response messages *

\* default

**Response Displays Q**

The *Q* command enables or disables response messages. The modem still responds to commands when the response display is inhibited.

Command	Operation
Q	Response display on*
Q1	Response display off
Q2	Response display on in originate mode only

\* default

**Negotiation Displays W**

The *W* command enables or disables negotiation response messages. These messages are verbose negotiation status displays to alert the user to the link rate, protocol, and DTE rate.

Command	Operation
W	Disables negotiation displays *
W1	Enables negotiation displays
W2	Displays DCE link rate only

\* default

**Protocol Result Codes \V**

Enable or disable protocol result codes. Table 5-1 lists these codes.

Command	Operation
\V	Disable protocol result codes *
\V1	Enable protocol result codes

\* default

**Call Progress / Connect Speed Messages X**

The *X* command selects response code/message displays and dialing options such as call progress monitoring, busy signal or dial tone detection and blind dialing.

Command	Operation
X	Dial tone and busy signal detection not selected; CONNECT (code 1) response messages displayed for all speeds
X1	Dial tone and busy signal detection not selected; appropriate CONNECT response messages or codes displayed for data rate
X2	Dial tone detection only; NO DIAL TONE message or code appears if dial tone not detected within 5 sec
X3	Busy signal detection only; BUSY message or code appears if dialed number is busy
X4	Dial tone and busy signal detection; appropriate CONNECT message or code displayed *

\* default

The *X* command followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6, and dial the number. If connection is made the modem returns a CONNECT (code 1) message to the screen regardless of the speed of connection. With a basic response, the modem will not detect a busy or no dial tone condition.

The *X1* command followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6, and dial the number. If connection is made the modem returns a appropriate CONNECT message or code to the screen. The modem will not detect a busy or no dial tone situation.

The *X2* command followed by a dial command causes the modem to go off hook and wait for a dial tone before dialing. If a dial tone is not detected within 5 seconds, the modem sends a NO DIALTONE message and hangs up. The modem will not detect a busy situation in this mode.

The *X3* command followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6 and dial the number. If a busy signal is detected, the modem sends a BUSY message and

hangs up. If the call is completed, the appropriate CONNECT message similar to *X1* will be displayed. The modem will not detect a no dial tone situation.

The *X4* command followed by a dial command causes the modem to go off hook and wait for a dial tone before dialing. If a dial tone is not detected within 5 seconds, the modem returns a NO DIALTONE message and hangs up. If a busy signal is detected, the modem returns a BUSY message and hangs up. If the call is completed, the appropriate CONNECT message similar to *X1* will be displayed.

The *X4* command combines all the features of *X1*, *X2*, and *X3*. The factory setting is *X4*.

 **Note**

*When an X2, X3, or X4 command is in effect, an appropriate CONNECT data rate message or code is displayed as for X1. When a blind dial command (X, X1, X3) is in effect, the modem waits 2 seconds or the time set by S6 and then dials.*

### Number Code Application \*RC

Some communications software packages use different number codes to indicate the data rate of the serial port. This option selects either of two commonly used number code sets.

Command	Code Set	Number	Operation
*RC	Standard *	15	4800 bps
		18	9600 bps
*RC1	Alternate	11	4800 bps
		12	9600 bps

\* default

 **Note**

*Asterisks in AT commands are part of the command and do not indicate footnotes.*

**Response Number Codes / Messages**

Response number codes, messages, and their corresponding meanings are listed in Table 5-1. The connect speeds indicated are the serial port rate (DTE), not the DCE speed.

**Table 5-1. Response Messages**

Code	Message	Meaning
0	OK	Command received
1	CONNECT	Connect at 300 bps while X1, X2, X3, or X4 command in effect; all rates while X command in effect
2	RING	Ring detected
3	NO CARRIER	Valid carrier not detected within period specified by register S7, or carrier lost for value of S10 or more
4	ERROR	Command not recognized or too long
5	CONNECT 1200	Connection made at 1200 bps
6	NO DIAL TONE	No dial tone detected for 5 seconds (X2 or X4 command in effect)
7	BUSY	Dialed number busy (X3 or X4 command in effect)
9	CONNECT 7200	DTE rate 7200 bps
10	CONNECT 2400	DTE rate 2400 bps
11, 15	CONNECT 4800	DTE rate 4800 bps
12, 18	CONNECT 9600	DTE rate 9600 bps
13	CONNECT 12000	DTE rate 12000 bps
14	CONNECT 19200	DTE rate 19200 bps
16	CONNECT 38400	DTE rate 38400 bps
17	CONNECT 14400	DTE rate 14400 bps
19	CONNECT 57600	DTE rate 57600 bps
20	CONNECT 0300/REL	MNP 300 bps connection
22	CONNECT 1200/REL	MNP 1200 bps connection
23	CONNECT 2400/REL	MNP 2400 bps connection
24	CONNECT 4800/REL	MNP 4800 bps connection
25	CONNECT 9600/REL	MNP 9600 bps connection

**Table 5-1. Response Messages (Continued)**

<b>Code</b>	<b>Message</b>	<b>Meaning</b>
26	CONNECT 19200/REL	MNP 19200 bps connection
27	CONNECT 38400/REL	MNP 38400 bps connection
28	CONNECT 7200/REL	MNP 7200 bps connection
29	CONNECT 12000/REL	MNP 12000 bps connection
30	CONNECT 14400/REL	MNP 14400 bps connection
31	CONNECT 57600/REL	MNP 57600 bps connection
32	CONNECT 600/REL	MNP 600 bps connection
34	CONNECT 300/LAPM	LAPM 300 bps connection
35	CONNECT 600/LAPM	LAPM 600 bps connection
36	CONNECT 1200/ LAPM	LAPM 1200 bps connection
37	CONNECT 2400/ LAPM	LAPM 2400 bps connection
38	CONNECT 4800/ LAPM	LAPM 4800 bps connection
39	CONNECT 9600/ LAPM	LAPM 9600 bps connection
40	CONNECT 14400/ LAPM	LAPM 14400 bps connection
41	CONNECT 19200/ LAPM	LAPM 19200 bps connection
42	CONNECT 38400/ LAPM	LAPM 38400 bps connection
43	CONNECT 12000/ LAPM	LAPM 12000 bps connection
44	CONNECT 7200/ LAPM	LAPM 7200 bps connection
45	CONNECT 57600/ LAPM	LAPM 57600 bps connection
50	CARRIER 300	Link rate 300 bps
51	CARRIER 1200	Link rate 1200 bps
52	CARRIER 2400	Link rate 2400 bps

**Table 5-1. Response Messages (Continued)**

<b>Code</b>	<b>Message</b>	<b>Meaning</b>
53	CARRIER 4800	Link rate 4800 bps
54	CARRIER 7200	Link rate 7200 bps
55	CARRIER 9600	Link rate 9600 bps
56	CARRIER 12000	Link rate 12000 bps
57	CARRIER 14400	Link rate 14400 bps
58	CARRIER 16800	Link rate 16800 bps
59	CARRIER 19200	Link rate 19200 bps
60	CARRIER 21600	Link rate 21600 bps
61	CARRIER 24000	Link rate 24000 bps
62	CARRIER 26400	Link rate 26400 bps
63	CARRIER 28800	Link rate 28800 bps
64	CARRIER 600	Link rate 600 bps
65	PROTOCOL NEGOTIATING	Training process complete and protocol negotiation begins
70	PROTOCOL NONE	No protocol active
71	PROTOCOL MNP LEVEL 1	MNP level 1 active
72	PROTOCOL MNP LEVEL 2	MNP level 2 active
73	PROTOCOL MNP LEVEL 3	MNP level 3 active
74	PROTOCOL MNP LEVEL 4	MNP level 4 active
75	PROTOCOL MNP LEVEL 5	MNP level 5 active
76	PROTOCOL V.42	V.42 LAPM active
77	PROTOCOL V.42BIS	V.42 bis LAPM compression active
78	CONNECT 300	DTE rate 300 bps
79	CONNECT 600	DTE rate 600 bps
80	CONNECT 16800	DTE rate 16800 bps
81	CONNECT 21600	DTE rate 21600 bps
82	CONNECT 24000	DTE rate 24000 bps

**Table 5-1. Response Messages (Continued)**

<b>Code</b>	<b>Message</b>	<b>Meaning</b>
83	CONNECT 26400	DTE rate 26400 bps
84	CONNECT 28800	DTE rate 28800 bps
85	CONNECT 115200	DTE rate 115200 bps
95	CONNECT 21600/ LAPM	LAPM 21600 bps connection
96	CONNECT 24000/ LAPM	LAPM 24000 bps connection
97	CONNECT 26400/ LAPM	LAPM 26400 bps connection
98	CONNECT 28800/ LAPM	LAPM 28800 bps connection
99	CONNECT 115200/ LAPM	LAPM 115200 bps connection

## DIAL COMMANDS

Dial commands let the modem originate a call to another modem. These commands can be used with either tone or pulse dial telephone systems. Commands for call answering are included at the end of this section.

### Dialing D

To dial a number, for example 554-1212 insert the *D* command in the dialing sequence.

*ATD 554-1212*

The modem dials the number, either pulse or tone, whichever is currently in effect, and takes the role of the originate modem.

Use spaces, hyphens, parentheses, or other punctuation except dial modifiers to make the command line easier to read and enter. For example, these are all treated the same:

AT D 1-800-555-1212  
 AT D 1 (800) 555-1212  
 ATD18005551212

The dial modifiers are shown in Table 5-2.

**Table 5-2. Dial Modifiers**

Command	Operation
T	Tone dialing*
P	Pulse dialing
,	Insert a long pause (2 sec or value in S8)
W	Wait for 2nd dial tone
!	Flash (1/2 sec)
R	Switch to answer mode after dialing
;	Return to command mode after dialing
@	Wait for silence
S	Dial stored command line or number

\* default

### **Tone Dialing T**

To tone dial a number sequence, insert a *T* in the dial sequence.

AT D T 323-1111

In this example, the modem tone dials the telephone number. The dialing method selected remains in effect until changed.

### **Pulse Dialing P**

To pulse dial a number sequence, insert a *P* in the dial sequence.

AT D P 554-9902

### **Insert Long Pause ,**

To insert a long pause in the dialing sequence, use a comma. This inserts a 2 second delay (or the value in register *S8*).

AT D P 9, 1-800-554-1000

Here the modem pulse dials a 9, pauses for the telephone system to switch to an outside line, then dials the phone number. Comma pauses may be inserted consecutively if desired.

**Wait for Second Dial Tone W**

To wait for second dial tone insert a *W* in the dialing sequence.

AT D 9 W 323-8000

Instead of using a comma pause for an outside line, wait up to 30 seconds (time specified by *S7*) for a second dial tone.

**Hook Flash !**

To flash the switchboard, insert an exclamation mark in the dialing sequence.

AT D T 9W 323-8000 ,!, #7 377

This inserts a 0.5 second on hook condition, usually for transferring a call or similar use.

In this example, the modem tone dials a 9, waits for the second dial tone, dials the phone number, pauses, flashes to start the transfer, pauses twice, then uses #7 to transfer the call to extension 377.

**Switching to Answer Mode after Dialing R**

To switch to answer mode after dialing, use an *R* at the end of the dial sequence.

AT D 554-2345 R

Use this command suffix to call an originate-only modem.

**Remaining in Command Mode ;**

To remain in command mode after dialing, place a semicolon at the end of the dial sequence.

AT D 234-5678;

The modem will dial the telephone number entered but will not attempt to train when the remote service answers the call.

This is used to retain control so that further dialing tones may be entered with the following:

AT DTn; (n= additional tones to be sent)

### **Wait for 5 Seconds of Silence @**

To wait for 5 seconds of silence (no answer back tone) after accessing an electronic service, use the @ command in the dialing sequence.

AT D 399-4700 @ 2251 ;

In this example the modem dials the number and, after the connection, waits for 5 consecutive seconds of silence. The modem then sends service code 2251 and returns to command mode for further input.

For example, you might enter a dollar amount for a banking transaction by entering

AT D 1400 ;

This sends the sequence 1400 and then returns to the command mode for further entries, according to the requirements of the banking service.

### **Dialing a Stored Telephone Number Sn**

To dial one of the previously stored numbers, enter *Sn* where *n* represents a stored telephone number location between 1 and 9.

AT D S9

In this example, the number stored in location 9 is dialed.



#### **Note**

*DS and DS1 are the same location.*

### **Autodial Number Location \*AUn**

The \*AUn command selects stored number n (n=1 to 9) to be autodialed. This is the autodial number, which is used for any autodial application.

### **Voice Calls**

To make a voice call, dial the number with the telephone. To use the dial command for the call, enter the following dialing sequence.

AT D (number);

The ; modifier recalls the command mode and prevents the modem from training. The remote site must be answered by the telephone for the voice call to be successful.

### **Switching from Voice to Data**

After dialing, place the modems at both ends in data mode by pressing the TALK/DATA button. The \*DA1 command can also be used to change from talk mode to data mode.

## **ANSWERING A CALL**

There are three ways to answer a call for a data connection:

- Manual
- AT Command
- Autoanswer

The most common is autoanswer.

### **Manual Answer**

When the phone rings, answer by pressing the TALK/DATA button.

### **AT Command Answer A**

The modem can be made to go off hook in the answer mode by entering ATA when the phone rings. This commands the modem to go to the answer mode and connect.

### **Autoanswer S0**

Autoanswer is controlled by register S0. S0 determines which ring the modem answers on. S0 can be loaded with a value between 1 and 255 for autoanswer.

Entering *ATS0=0* disables the autoanswer feature. Decide which ring the modem is to answer on and set S0 to that decimal value.

When S0 is one or greater, the modem automatically answers on the selected ring and connects with the calling modem.



**Note**

*If the modem is set to respond to DTR the DTR signal must be on for autoanswer to work.*

## TERMINAL INTERFACE COMMANDS

The EIA-232 interface connects the modem and DTE. Terminal interface commands control the action of the modem and the terminal in response to the signals being exchanged on the interface pins. Refer to Table 2-1.

### Data Carrier Detect &C

When using DCD to indicate a valid carrier, use the *&C1* command. Some terminals and other devices require DCD on in order to communicate with the modem; if so, use the *&C* command.

Command	Operation
<i>&amp;C</i>	DCD always on*
<i>&amp;C1</i>	DCD is on when the modem recognizes remote modem carrier or if enabled when protocol negotiation is complete.
<i>&amp;C2</i>	DCD on except for 5 seconds after disconnect
<i>&amp;C3</i>	DCD follows RTS on remote modem ( <b>simulated switched carrier V.13</b> ).

\* default

*AT&C3* is used to simulate switched carrier operation.



**Note**

*For simulated switched carrier operation &C3 must be selected on both modems. Not available in the B103 and V.21 modulation modes.*

**Data Set Ready &S**

These commands control the DSR signal generated by the modem to indicate that the modem is ready for operation. DSR must be on for some terminals and devices to communicate with the modem.

Command	Operation
&S	DSR always on*
&S1	DSR on when off hook in data mode
&S2	DSR off for 5 seconds after disconnect then returns to on
&S3	DSR follows off hook (OH) signal

\* default

**Data Terminal Ready &D**

In data mode DTR may be used for modem control.

Command	Operation
&D	The modem ignores DTR.*
&D1	The modem goes to command mode from data mode when DTR goes from on to off.
&D2	Disconnects when DTR goes from on to off; disables autoanswer while DTR is off
&D3	Disconnects, recalls command mode, and resets the modem to a stored configuration when DTR goes from on to off  In dial line mode the modem disconnects; in leased line, the modem retrains.

\* default

**Note**

If DTR controls dialer is selected, then selecting DTR active will cause an autodial after an off-to-on transition of DTR.

### **Serial Port Ring Indicator (Pin 22) \R**

The \R commands determines how the ring indicate signal operates on pin 22 of the EIA-232 DTE connector.

Command	Operation
\R	Causes ring indicate signal on pin 22 to turn on (high) during each ring and remain on during the call
\R1	Causes ring indicate signal on pin 22 to turn on (high) during each ring and turn off (low) when the call is answered *

\* default

### **Request to Send / Clear to Send &R**

When the modem is operating in nonbuffered mode (direct mode) or in synchronous mode, &R enables the RTS to CTS delay determined by the value in S26. &R1 forces CTS high and the modem ignores RTS (default). With &R2 selected CTS goes high when carrier is detected. &R9 forces CTS to follow the state of RTS without delay.

Command	Operation
&R	Enables RTS to CTS delay
&R1	CTS forced on*
&R2	CTS follows DCD
&R9	CTS equals RTS

\* default



#### **Note**

*RTS/CTS delay is not valid in buffered mode or with error control enabled.*



#### **Note**

*With &R2 selected, XON/XOFF is the only valid method of flow control and &C and &C1 are the only valid carrier detect options.*

**DTE Controlled Fallback Rate (Pin 23) \*FB**

Pin 23 of the EIA-232 DTE connector provides signal input to the modem for DTE fallback. If the modem is not using DTE fallback, set this option to ignore pin 23. To cause the modem to act on high/low levels of pin 23, enable this option. Negative level forces a higher rate for primary data rate; positive forces a lower rate providing a fallback rate.

Command	Operation
*FB	Ignore pin 23 *
*FB1	Transition on pin 23 changes speed

\* default

**GENERAL COMMANDS**

This series of commands control various standard options that in most cases apply to any mode of operation.

**Changing from Data Mode to Command Mode +++**

To exit data mode and go to online command mode, press the escape character three times (+ is the default). Pause for the length of time set by register S12 (1 second is the default) before and after the +++ to ensure the modem recognizes the escape command.

This sequence temporarily suspends data mode transmissions and allows command mode operations without breaking or otherwise disturbing the telephone line connection. The modem responds with OK when it detects the escape code. Return to data mode by entering the *O* command.

 **Note**

*The AT command set must be enabled.*

**Local Character Echo E**

Type *AT* without a carriage return. If the screen shows *AT* character echo is correct. Proceed with other commands as desired.

If the screen shows *AATT* enter the *E* command to correct the double characters or disable character echo by the modem.

If the screen shows no characters, enter the *E1* command to turn modem echo on or enable local echo on the terminal.

Command	Operation
E	Echo off
E1	Echo on *

\* default

### **Online Character Echo F**

In some lower speed modems the *F* command determines if characters are echoed to the DTE from the modem when online. This function is generally controlled by the communications software. The modem does not support online character echo.

### **Hanging Up H, H1**

To end a call, enter the *H* command. This tells the modem to disconnect and go on hook. The modem must be in command mode to use this command.

Enter the *H1* command to take the modem off hook. The modem automatically goes off hook when a dial command is keyed in.

### **Fast Disconnect H2, H3**

The results of the *H* command can be modified by the *H2* and *H3* commands. *H2* or *H3* will not cause a hang up but will affect the method of hanging up the next time the *H* command is issued. If *H2* is entered, the *H* command will hang up according to CCITT V.32 standards. If operating in V.32b mode the *H2* command could take several seconds. If *H3* (the fast command) is entered, the *H* command will hang up much more rapidly at those speeds.

Command	Operation
H	The modem hangs up.
H1	Forces modem off hook
H2	Sets H command to normal hangup procedure (long space, cleardown, protocol) *
H3	Sets H command to fast hang up

\* default

**EPROM Check I**

PC software packages may issue the *I* command to verify the modem will support all commands needed by the software package. The modem returns ASCII characters representing the model and revision level. To request the checksum to be calculated on the EPROM, enter the *I1* command. The modem returns four ASCII characters representing the CRC in hexadecimal form. Enter the *I3* command to request the product version.

Command	Operation
I	Request product code
I1	Request EPROM checksum value
I3	Request product version
I4	Request capability code
I5	Last disconnect reason

**Speaker Volume L**

The *L* commands offer three volume levels.

Command	Operation
L, L1	Speaker volume low
L2	Speaker volume medium *
L3	Speaker volume high

\* default

**Speaker Control M**

The *M* commands enable or disable the speaker for monitoring purposes.

Command	Operation
M	Disables the speaker
M1	Disables the speaker while receiving a carrier signal *
M2	Speaker always on
M3	Disables the speaker while dialing and after a carrier is detected

\* default

**Return Online O**

Use the *O* command when operating in the online command mode and need to return to data mode. It returns the modem to the same mode (originate or answer) that it was in before escaping to the (online) command mode. Enter the *OI* command to cause a retrain to occur before going back to data mode.

**Long Space Disconnect Y**

One method of disconnecting two modems is called long space disconnect. When any disconnect condition is detected by the local modem, it will send 4 seconds of data space condition to the remote modem before disconnecting. This signals the remote modem to disconnect. The local modem will disconnect if it receives 1.6 or more seconds of data space condition from a remote modem. If break sequences of 1.6 or more seconds are to be sent, enter the *Y* command to disable this feature and prevent unintentional disconnects.

**Note**

*This option must be disabled if SDLC NRZI data is used.*

Command	Operation
Y	Long space disconnect off
Y1	Long space disconnect on*

\* default

**V.22 bis Guard Tones &G**

Guard tones are not used in the United States. If required where operating the unit, select the appropriate guard tone.

Command	Operation
&G	No guard tone*
&G1	550 Hz guard tone
&G2	1800 Hz guard tone

\* default

**Asynchronous / Synchronous Mode Selection &M**

The **&M** commands select synchronous or asynchronous operation and synchronous dial method.

The **&M** command selects asynchronous data mode.

The **&M1** command selects synchronous data mode 1. Calls are placed asynchronously. Operation switches to synchronous after connecting with the remote modem.

The **&M2** command selects synchronous data mode 2. The modem automatically dials a stored number when it detects a DTR off-to-on transition. DTR must be programmed to be active by the **&D** commands.

The **&M3** command selects synchronous data mode 3. Calls are placed manually.

The **&M4** command selects synchronous data mode 4 with V.25 bis autodialer set for Bisync protocol.

The **&M5** command selects synchronous data mode 5 with V.25 bis autodialer set for SDLC protocol.

The **&M6** command selects synchronous data mode 6 with V.25 bis autodialer set for asynchronous.

Use register S30 to select NRZ/NRZI for data format if using SDLC.

Command	Operation
<b>&amp;M</b>	Async mode (V.25 bis disabled) *
<b>&amp;M1</b>	Sync mode 1 (AT commands if enabled)
<b>&amp;M2</b>	Sync mode 2 (DTR dials if active)
<b>&amp;M3</b>	Sync mode 3 (manual calls)
<b>&amp;M4</b>	Sync mode 4 with V.25 bis bisync
<b>&amp;M5</b>	Sync mode 5 with V.25 bis SDLC
<b>&amp;M6</b>	Sync mode 6 with V.25 bis async

\* default

**Caution**

*Synchronous terminal equipment must be available to communicate with the modem if the V.25 bis dialer is enabled.*

**Make / Break Dial Pulse Ratio &P**

Use the **&P** command for the dial pulse to be on for 39% and off for 61% of one cycle. Use the **&P1** command for the dial pulse to be on for 33% and off for 67% of one cycle.

Command	Operation
<b>&amp;P</b>	39% : 61% US and Canada *
<b>&amp;P1</b>	33% : 67%

\* default

**Synchronous Transmit Clock Source &X**

The **&X** commands select internal, external, or receive clock as the transmit clock source.

Command	Operation
<b>&amp;X</b>	Internal clock *
<b>&amp;X1</b>	External clock
<b>&amp;X2</b>	Receive clock

\* default

**V.34 Rate Selection Thresholds \*TH**

The **\*TH** commands sets the V.34 rate selection thresholds. The V.34 modulation dynamically selects the optimum bit rate to run, based on line quality.

Command	Operation
<b>*TH</b>	Low threshold ( $10^{-6}$ BER)
<b>*TH1</b>	Medium threshold ( $10^{-4}$ BER)
<b>*TH2</b>	High threshold ( $10^{-2}$ BER) *

\* default

**V.34 Asymmetric Bit Rates \*AS**

The \*AS command enables or disables the V.34 Asymmetric bit rate capability. This feature allows the modem to run different bit rates on the receiver and transmitter.

Command	Operation
*AS	Disable V.34 Asymmetric bit rates
*AS1	Enable V.34 Asymmetric bit rates

**Modulation \*MM**

The \*MM command sets the current modulation type to use when attempting to make a connection. Using this command automatically selects the maximum DCE speed (%B) for the selected modulation.

Command	Operation
*MM	Automode (typically used on dial line)
*MM1	V.21
*MM2	B103
*MM3	Reserved
*MM4	B212A
*MM5	V.22 bis
*MM6	V.27 bis 4-wire leased only
*MM7	Reserved
*MM8	V.29 4-wire leased only
*MM9	Reserved
*MM10	V.33 4-wire leased only
*MM11	V.32 bis
*MM12	V.34

**Maximum DCE Speed %B**

The %B commands set the originating DCE speed to follow the DTE speed. When originating a call the two modems will not connect at a speed faster than the lower DCE speed setting of the two modems. To allow the modem to transmit data at a speed different from DTE speed, enter the %Bn command where n=1 to 16.

Command	Operation
%B	Use DTE speed
%B1	300 bps
%B2	1200 bps
%B3	2400 bps
%B4	4800 bps
%B5	9600 uncoded bps
%B6	9600 bps
%B7	7200 bps
%B8	12000 bps
%B9	14400 bps
%B10	Reserved
%B11	16800 bps
%B12	19200 bps
%B13	21600 bps
%B14	24000 bps
%B15	26400 bps
%B16	28800 bps*

\* default

**Note**

*The %B command should be used after the \*MM command when specific modulations are required.*

**Minimum DCE Speed %L**

If the modem connects at a rate lower than the minimum DCE speed, it disconnects the link automatically.

Command	Operation
%L	Disabled
%L1	Disabled *
%L2	1200 bps
%L3	2400 bps
%L4	4800 bps
%L5	9600 uncoded bps
%L6	9600 bps
%L7	7200 bps
%L8	12000bps
%L9	14400 bps
%L10	Reserved
%L11	16800 bps
%L12	19200 bps
%L13	21600 bps
%L14	24000 bps
%L15	26400 bps
%L16	28800 bps

\* *default*

**Auto Retrain %E**

This option allows the modem to automatically retrain in response to poor received signal quality without reconnecting. The modem always responds to a retrain request from the remote modem.

Command	Operation
%E	Disable auto retrain
%E1	Enable auto retrain *

\* *default*

## Automatic Rate Adaption %R

Automatic rate adaption (ARA) allows the modem to automatically decrease the DCE rate when the allowable bit error rate is exceeded. If condition improves the modem automatically increases the rate.

Select this feature by front panel operation or AT command. Options include disabled (factory default), low (BER= 1 in  $10^5$  ), medium (BER= 1 in  $10^4$  ), high (BER= 1 in  $10^3$  ).

The following apply to automatic rate adaption:

- Automatic rate adaption is disabled during direct mode.
- Manual rate adaption is disabled from the front panel when automatic rate adaption is enabled.
- Only one increment or decrement in the DTE rate is allowed at a time during rate adaption from the initiating modem.
- When online, initiator rate adaption occurs a maximum of every 12 to 14 seconds from the last occurrence of a rate adaption.
- After the modem drops data rate because of poor signal quality, the line must improve by approximately 2.5 dB before an increase in rate can occur.



### Note

*Automatic rate adaption is disabled during direct mode.*

If automatic rate adaption is enabled, the modem automatically decreases DCE rate if signal quality deteriorates beyond the allowable bit error rate. If signal quality improves, the modem increases DCE speed.

Command	Operation
%R	Disable automatic rate adaption *
%R1	Enable automatic rate adaption using low BER: 1 in $10^5$
%R2	Enable automatic rate adaption using medium BER: 1 in $10^4$
%R3	Enable automatic rate adaption using high BER: 1 in $10^3$

\* default

**Manual Rate Adaption \*RR**

The \*RR command forces the modem to re-adapt the DCE rate with the remote modem.

Command	Operation
*RR	Rate adaption to 2400
*RR1	Rate adaption to 4800
*RR2	Rate adaption to 7200
*RR3	Rate adaption to 9600
*RR4	Rate adaption to 12000
*RR5	Rate adaption to 14400
*RR6	Rate adaption to 16800
*RR7	Rate adaption to 19200
*RR8	Rate adaption to 21600
*RR9	Rate adaption to 24000
*RR10	Rate adaption to 26400
*RR11	Rate adaption to 28800

**Product Revision Level %V**

The %V command displays the product revision level.

**Online Quick Reference \$H**

The \$H command displays an AT command set quick reference. The <return> key terminates the page displays and any other key scrolls through the pages.

Command	Operation
\$H	Displays online quick reference
\$H=<string>	Search online quick reference for string.

**Product Serial Number \$V**

The \$V command displays the product serial number.

**Permissive / Programmable %Z**

For dial-up operation the modem transmitter output can be set in two different modes of operation. In permissive (RJ11 jack), transmit output level is set to -9 dBm. To set the modem for permissive mode enter the %Z command. In programmable (RJ45 jack) operation, the transmit level is set by an external program resistor. This mode is selected with %Z1.

Command	Operation
%Z	RJ11 (permissive) *
%Z1	RJ45 (programmable)

\* default

**Note**

Selecting programmable jack (RJ45) without a programmable jack causes the transmit level to be -12 dBm.

**Talk / Data \*DA**

The \*DA commands select talk or data mode.

Command	Operation
*DA	Switches modem to talk *
*DA1	Switches modem to data

\* default

**V.32 Fast Train \*FT**

The V.32 fast train option is used to reduce training time when operating over high quality, limited distance dial or 2-wire leased lines.

Command	Operation
*FT	Disable fast train *
*FT1	Enable fast train

\* default

**Incoming Call \*IC**

The \*IC command causes the modem to disregard an incoming call.

**Line Current Disconnect \*LC**

Dial line operation only. The modem can be configured to disconnect upon loss or interruption of telephone line current.

Command	Operation
*LC	Line current disconnect off
*LC1	Line current disconnect short (8 ms)
*LC2	Line current disconnect long (90 ms) *

*\* default*

**Disable AT Command Set \*NT**

The \*NT command disables the AT command set.

The \*NT1 command allows the user at a remote modem to enable AT command operation of another modem via remote configuration.

Command	Operation
*NT	Disable AT command set
*NT1	Enable AT command set at remote site *

*\* default*

If the AT command set of a local modem is accidentally disabled and must be recovered locally, alternate power on and off seven times. The time that power is on must be greater than 1 second but less than 5 seconds. This process loads factory set 1 as the powerup configuration, enabling the AT command set.

**Dial Line Transmit Level \*TDn**

Command	Operation
*TDn	Sets dial line TX level to <i>n</i> where <i>n</i> is a number 9 through 30 corresponding to a TX level of -9 to -30 dBm

## PRIVATE LINE OPERATION



### Note

*For a 2- or 4-wire leased line connection to succeed one modem must be configured as forced answer and the other modem as normal originate. Both modems should have only one protocol, MNP or LAPM, enabled and PROTOCOL FALLBACK must be disabled. DCE line speed must be the same for both modems.*

### 4-Wire Operation

In 4-wire operation, the modem is a full-duplex, leased-line modem requiring a dedicated 4-wire leased line. Only point-to-point dedicated leased lines are supported. The 4-wire leased line connects to the AUX jack on the modem rear panel. Dialing is not necessary. When connected via leased line the modems will train and begin communicating with each other. The LINE jack can be used to connect a 2-wire dial-up line for dial backup.



### Note

*The V3229, V3227, V3225, and V3257 modems use V.33 as the modulation type. The V.3400 must be set up to V.33 to connect to these modems.*

### 2-Wire Operation

In 2-wire operation, the modem is a full-duplex modem able to operate over 2-wire leased or PSTN lines.

#### 2-wire Leased Line Operation:

The 2-wire leased line is connected to the AUX jack; the LINE jack connects to a 2-wire dial-up line for dial backup. The leased line connects the local and remote modems directly and dialing is not necessary. One of the modems must be configured for forced answer and the other for normal originate. When connected via leased line the modems will connect and begin communicating with each other.

The **&L** command is used to select Private Line (leased line) operating mode. The **\*OR** commands selects the origination or answer mode when operating in the leased line configuration.

**Note**

*DTR must be held high in 2-wire or 4-wire leased line operation. This is accomplished by DTE control, wiring pin 20 of the digital interface cable high, or by selecting the option, IGNORES DTR. If DTR is terminal controlled, loss of synchronization can be corrected by cycling DTR. This causes the modem to initiate the 2-wire training sequence. DSR goes off during the training procedure.*

**2-wire Dial-up Operation:**

Connection to the telephone network is through the LINE jack. A standard telephone can be connected to the AUX jack for manual dialing.

**Dial Backup**

Dial backup allows the modem to switch to a dial backup mode if the data connection on the leased line is unacceptable for communications. This can be accomplished in two ways:

- Automatic - backup due to extended loss of carrier or 4 unsuccessful retrains in 3 minutes
- Manual - user determined using front panel controls or AT commands

**Caution**

*In leased line operation, if both units have autodial backup enabled, one must be configured for forced answer. This prevents both units from dialing if the leased line fails.*

Both methods will cause the modem to dial the prestored autodial number. The originate modem will wait for 5 seconds and then initiate the call. The answer modem will wait for a ring. The modems then train and begin communicating over the dial-up line. If the dial connection is unsuccessful after three attempts, a retrain on the leased line will be initiated.

In manual mode, the return to leased line is only done when commanded. In automatic mode the return to leased line is initiated after the lookback time in register S28 has elapsed. To prevent unnecessary termination of the dial line connection, a leased line lookback test is performed. If the leased line is not acceptable, the dial connection is resumed with a retrain. If the leased line is acceptable, the dial connection is dropped and normal leased line mode is resumed.

When the unit attempts to return to leased line, the LCD displays LEASE LOOKBACK. If the leased line has been restored to service, data can be passed approximately 10 seconds after LEASE LOOKBACK was initiated. The LCD will continue to display LEASE LOOKBACK for slightly more than a minute. During this time the dial line connection is maintained if a return to dial line operation is required. When the LCD displays ON LINE again the dial line is disconnected.



### **Note**

*A diagnostic test initiated during dial backup mode terminates when the modem performs a leased line lookback.*

### **Dial / Leased Line &L**

&L selects line operation as required:

Command	Operation
&L	Dial (switched) *
&L1	Leased (private) 2-wire
&L2	Leased (private) 4-wire

\* default

**Dial Backup \*DB**

Command	Operation
*DB	Manual dial backup operation *
*DB1	Automatic dial backup operation

\* default

**Return to Leased Line from Dial Backup \*LB**

During dial backup operation, \*LB causes the modem to return to leased line operation.

During leased line operation with forced answer enabled, \*LB causes the modem to wait for a dial backup call.

**Manual Dial Backup \*LD**

\*LD dials the autodial number if the modem is in originate mode with manual dial backup selected. Leased line operation only.

**Answer / Originate \*OR**

\*OR forces the modem to answer or originate mode. This option is used during 2- and 4-wire leased line operation with error correction and/or dial backup.

Command	Operation
*OR	Force originate *
*OR1	Force answer

\* default

**Leased Line Transmit Level \*TLn**

Command	Operation
*TLn	Sets leased line TX level to <i>n</i> where <i>n</i> is a number 0 through 30 corresponding to a TX level of 0 to -30 dBm

## **CONFIGURATION COMMANDS**

These commands recall various profiles for insertion into the active profile, store the active profile and telephone numbers in nonvolatile memory, and designate the powerup profile. Remote configuration is discussed at the end of this section.

## **CONFIGURATION PROFILES**

Modem operations are controlled by option settings selected from factory defaults stored in ROM, active settings stored in RAM, and custom settings stored in nonvolatile memory. These three code storage locations are called profiles.

### **Active Profile**

The active profile holds the current option settings and is used by the modem for all operations and functions. Any active profile option can be changed to meet an immediate requirement. The active profile is maintained in volatile memory referred to as S-registers.

### **Stored Profile**

When an active configuration is established that meets all operating requirements, it can be transferred to one of the stored profiles. Two stored profiles are available for greater versatility.

If the active profile has been temporarily changed it can be reset to either of the stored profiles with the Z command. The &Y command selects one of the two stored profiles to be the powerup profile.

### **Factory Profile**

The factory configurations are stored in ROM and cannot be changed by the user; they can be transferred to the active profile and then modified to fit a specific application if needed. The &F command recalls one of the nine factory configurations.

## Storing a Configuration &W

The &W commands store the current configuration options in one of two nonvolatile memory locations (Figure 5-1). The stored configurations are retained in memory even when power is off, or until &W is issued with a new configuration options with a single command.

Command	Operation
&W	Store options to user option set 1 *
&W1	Store options to user option set 2

\* default

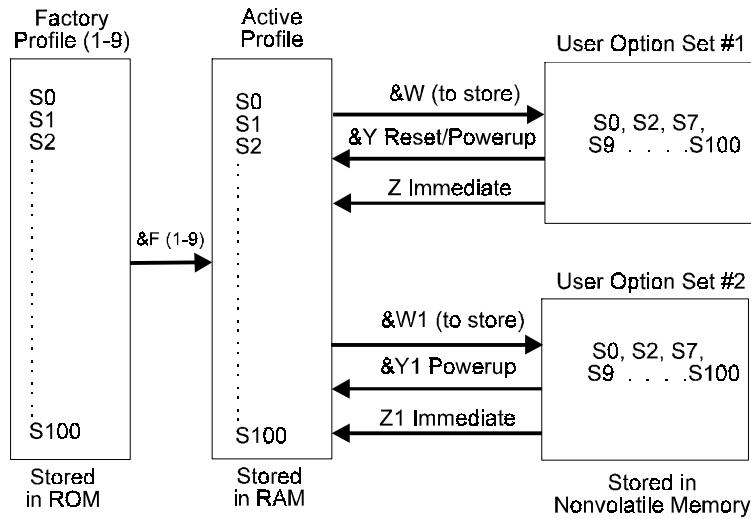


Figure 5-1 Configuration Storage and Recall

**Powerup Option Set &Y**

The &Y command determines which user option set is loaded during powerup and reset.

Command	Operation
&Y	Powerup with user option set 1 *
&Y1	Powerup with user option set 2
&Y?	Displays currently selected powerup option set

\* default

**Load Factory Options &F**

The &Fn command loads one of the existing configuration sets, providing a complete configuration for a compatible system/network environment. Refer to Appendix E for a complete list of the options in each set.

Command	Operation
&F, &F1	Load factory option set 1 (async dial-up with V.42 bis) *
&F2	Load factory option set 2 (async dial-up without V.42 bis)
&F3	Load factory option set 3 (sync dial-up without V.42 bis)
&F4	Load factory option set 4 (sync 4-wire leased line without V.42 bis)
&F5	Load factory option set 5 (async 4-wire leased line with V.42 bis)
&F6	Load factory option set 6 (async 4-wire leased line without V.42 bis)
&F7	Load factory option set 7 (sync 2-wire leased line normal originate)
&F8	Load factory option set 8 (sync 2-wire leased line forced answer)
&F9	Load factory option set 9 (sync V.25 bis dialer)

\* default

**Reset to Stored Configuration Z**

The Z commands reset the modem and immediately load either user option set 1 or 2 as the current configuration. This command saves time once a proven configuration is established.

Command	Operation
Z	Resets the modem and immediately loads user option set 1*
Z1	Resets the modem and immediately loads user option set 2

\* default

**View Configuration Profiles / Received Signal Options &V**

This command allows the user to view the current configuration profile in the form of S-register values. &V1 displays the received signal options.

Command	Operation
&V	Displays configuration profiles *
&V1	Displays received signal options
&V2	Displays active profile

\* default

**Storing a Telephone Command Line &Z, (\*CNx,n), \*ND**

Nine stored phone number locations of up to 31 characters each are available in nonvolatile memory. Normally, one phone number per location is accommodated. However, a phone number longer than 31 characters can overflow into the next location. Any spaces remaining in the overflowed location cannot be used for another number. The stored phone number is retained until replaced by another number. Modem power can be turned off without affecting stored information.

Two commands can store phone numbers:

- &Z inserts a phone number in location one only.
- \*CN inserts phone numbers in locations one through nine.

To store a telephone command line in location one enter the &Z command followed by the desired command sequence of digits and modifiers.

## AT &Z 554-1212

In this example the command sequence to dial the indicated number is stored at location 1 for later dialing.

 **Note**

*Neither the AT prefix nor the D command should follow the &Z.*

**&Zn** - Stores telephone number *n*, including dial modifiers, at location 1 (up to 31 digits).

**\*CNx,n** - Stores telephone number *n*, including dial modifiers, at location *x* (*x=1 to 9*).

**\*CNx,-** Clears telephone number location *x*

**\*ND** - Displays the stored numbers (1-9).

## **Retaining / Restoring Options \*RO**

This option is used when the modem is shared by two or more DTEs.

When options are retained, the current configuration is not altered at disconnect. With options restored, the modem returns to the previously stored configuration on disconnect.

When options are restored at disconnect, the following commands return OK but are not executed:

**\*CN** Store telephone number  
**&Z** Store telephone number  
**&F** Recall factory configuration  
**&W** Store current configuration

Command	Operation
<b>*RO</b>	Retain options at disconnect *
<b>*RO1</b>	Restore options at disconnect

*\* default*

## REMOTE CONFIGURATION

This mode of operation allows viewing or modifying the options of a remote modem that supports Motorola UDS remote configuration.

Remote configuration is performed using the front panel LCD or more commonly AT commands from the local terminal. Remote configuration is initiated by the local (master) modem through a proprietary protocol, a security code, and an acknowledgment from the remote (slave) unit to be modified. The security code is user inserted and provides protection from unauthorized entry. The modems are shipped from the factory without a security code.

 **Note**

*Remote configuration is supported at all rates except 300 bps.*

### Remote Configuration Security

The correct security code must be received by the remote modem before remote configuration can be established. Once established, the local DTE becomes a virtual terminal and can serve both local and remote modems. After starting remote configuration, the local DTE serves the remote modem.

To return DTE service to the local modem while in remote configuration, issue the +++ escape sequence.

DTE service can again be returned to the remote modem by issuing the *O* command. Switching DTE service between local and remote modems may be performed as needed.

To exit remote configuration, return DTE service to the local modem. The *&T* command will exit remote configuration mode.

Remote configuration may be entered immediately after dialing by placing the remote configuration command (%T=), without the = sign and followed by the security code, at the end of the dial string.

### Remote Security Code %P=

A security code prevents unauthorized access to remote configuration mode. This code is separate from low and high security passwords, which are discussed under Security in the next section. The security

code is user programmable and can be set to any value from a single 0 to any combination up to 99999999 using the *%P=(desired code)* command.

Example: If the remote modem security code is *I2345*, the local modem must include this code in the initialization string before the remote modem responds.

Command	Operation
%P=	Sets security code to a value 0 to 99999999 entered after the equal sign
%P?	Requests local security code to be displayed
%P=D	Access for remote configuration is not possible when security code is disabled
%P=(blank)	Clears security code *

\* *default*

The *%P=D* command disables remote configuration. To enable remote configuration, insert another security code.

### **Entering Remote Configuration %T=, &T**

This mode of operation allows the modem user to view or modify the option set of a compatible remote modem. Enter the *%T= (security code of remote)* command to initiate remote configuration.

The modem is shipped from the factory with security code (*blank*). This allows remote configuration by using (*blank*) as the security code.

Command	Operation
%T=	This command followed by the correct security code establishes remote configuration
&T	Exits remote configuration

Remote Configuration can also be specified by the dial command by placing *%T (password)* after the dial digits (the equal sign is left off).

Example: ATD 555-1212%T01234

## Chapter 6 Protocols

### CCITT V.42 BIS ERROR CONTROL PROTOCOL

V.42 bis is an industry standard for error control adopted by the Consultative Committee for International Telephone and Telegraph (CCITT). The CCITT V.42 bis protocol incorporates two error control algorithms, LAPM and MNP. LAPM is a CCITT Link Access Protocol family member related to LAPB and LAPD currently in use in other communications applications. MNP is Microcom Networking Protocol that has become an industry standard by the number of its users.

The use of V.42 bis requires both local and remote modems to be V.42 bis compatible. Error control protocol is transparent to the user and requires no special hardware or software. Data to be transmitted is put in a buffer so the modem can retransmit it if an error occurs. The modem also buffers data received from the remote modem in case an error occurs and the data is retransmitted. To avoid overfilling the buffer, flow control is used to control data between the modem and the terminal. V.42 bis protocol options can be set by AT commands.

 **Note**

*Error control protocols are only valid when using asynchronous DTE options.*

### RELIABLE

When a LAPM or MNP link is established the modem is in reliable mode. V.42 bis allows negotiation with a remote modem to the highest level of protocol common to both units. Both LAPM and MNP control data errors by retransmitting any block of data that was corrupted in transit. LAPM is assigned highest priority and if not supported, then an MNP connection is attempted.

### AUTO-RELIABLE

In auto-reliable mode the modem negotiates to the highest protocol (LAPM or MNP) common to both modems. However, if a reliable connection cannot be established, auto-reliable allows the protocol to fallback to normal mode.

## **CONSTANT SPEED INTERFACE**

The modem serial port adapts to the data rate of the DTE and does not change speed if the (modem) data link connects at another speed. Therefore the DTE to DCE interface speed is constant.

## **DATA COMPRESSION**

Using MNP Class 5 data compression, the modem can achieve data throughput approaching 28800 bps. With LAPM data compression, the modem can achieve data throughput approaching 115200 bps. This increase in speed is achieved by automatically analyzing the data stream and reducing the number of bits required to represent the characters. 100% error-free transmission is assured by the application of the MNP or LAPM error control protocol on the compressed data.

Compression takes place only if the modem detects that the remote modem supports compression. If not, a reliable connection is made without compression.

Although data compression is compatible with any type of data, it is most efficient for ASCII text files. For maximum throughput when using data compression, the terminal should be set to a higher speed than the connect speed with the constant speed interface on and flow control enabled. When transmitting or receiving data files in one direction, the throughput can be increased for V.42 bis by having extra buffer and more processor time with the %C2 and %C3 data compression commands.

## **NORMAL MODE**

No error control with or without constant speed DTE interface. Data is buffered.

## **DIRECT MODE**

The DTE speed and DCE speed are forced to be the same. No error control or buffering.

**Note**

*In direct mode and the DCE link is established at a rate other than the original DTE speed, the modem will issue the connect message for the new DTE speed at the original rate. All subsequent data will be sent to the DTE at the new DCE speed.*

## FLOW CONTROL

If the serial port speed exceeds that of the modem connection, characters may be sent by the DTE to the modem faster than it can send them to the remote modem. The modem holds characters in an internal buffer until they can be transmitted. When this buffer is full, the modem uses flow control to cause the DTE to stop sending characters. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data. The modem can use hardware flow control (RTS/CTS) or in-band flow control (XON/XOFF).

## PROTOCOL COMMANDS

These commands enable or control the various data compression, flow control, and error correction options of the modem. Table 6-1 illustrates mode and the associated features.

*Table 6-1. Operating Modes and Conditions*

Operating Mode	Error Correction	Data Compression	Flow Control	Data	Constant Speed Interface
Normal	Disabled	Not applicable	Allowed	Buffered	On or off
Direct	Disabled	Not applicable	Not applicable	Not buffered	DTE=DCE (slaved)
Reliable (MNP and LAPM)	Enabled	On or off	Allowed	Buffered	On
Auto-reliable (MNP and LAPM)	Enabled	On or off	Allowed	Buffered	On

**Disconnect Buffer Delay %D**

Select a delay during which the modem processes data in its transmit and receive buffers before disconnecting. When a condition exists which causes a disconnect, the modem tries for n seconds to empty its buffers. When the buffers are empty or if  $n=0$ , the modem disconnects immediately.

Command	Operation
%D	Disconnect buffer delay disabled *
%Dn	Disconnect buffer delay value ( $n = 1-255$ seconds)

\* default

**Serial Port (DTE) Constant Speed \J**

The \J command allows DCE and DTE to operate at different speeds. The \JI command forces serial port (DTE) speed to follow data link speed in any mode.

If the modem is in direct mode (\JI) and a DCE link is established at a speed other than that of the original DTE autobaud speed, the modem will issue the CONNECT message for the new DTE speed at the original rate. All subsequent data will be sent to the DTE at the new DCE speed.

Command	Operation
\J	Disable slaved DTE/DCE (constant speed DTE on)*
\JI	Enable slaved DTE/DCE (constant speed DTE off)

\* default

**V.42 Optional Detection Phase \M**

This is a data sequence that speeds up the LAPM link negotiation time if V.42 LAPM is supported by the remote modem.

Command	Operation
\M	V.42 fast detect data sequence disabled
\M1	V.42 fast detect data sequence enabled *

\* default

**Operating Mode \N**

Select the V.42b mode to be used in data mode. An \Nn command issued during command mode while a connection is in progress will not affect the current connection but will be acted on for subsequent connections. LAPM or MNP protocol operation is referred to as MNP-only mode, and the auto-reliable modes allow protocol fallback.

Command	Operation
\N	Normal mode — no error control; data buffered
\N1	Direct mode — no error control; data not buffered
\N2	MNP only — try MNP; disconnect if not successful
\N3	MNP or normal — try MNP; fallback to normal async
\N4	LAPM only — try LAPM; disconnect if not successful
\N5	LAPM or normal — try LAPM; fallback to normal
\N6	LAPM or MNP — try both protocols; disconnects if not successful
\N7	LAPM, MNP, or normal — try both protocols; fallback to normal if not successful *

\* default

**Auto-Reliable Fallback Character %An**

Select the ASCII character to be recognized as the auto-reliable fallback character by the answering modem. During negotiation of protocol in auto-reliable mode, the answering modem switches from reliable to normal mode when receiving the auto-reliable fallback character from the calling modem and passes the character to the serial port.

Enter the %An command to set the auto-reliable fallback character ( $n=1\text{-}27$  decimal representing an ASCII character).

Command	Operation
%A0	Disable auto-reliable fallback character *
%An	Sets ASCII character to be recognized as the auto-reliable fallback character

\* default



### Note

*The modem must be set for auto-reliable mode (AT\N3, \N5, \N6, \N7).*

## Serial Port Flow Control \Q

The \Q commands set the type of flow control used by the serial port. If the serial port speed exceeds that of the modem connection, characters may be sent by the DTE to the modem faster than it can send them to the remote modem. The modem holds characters in an internal buffer until they can be transmitted. When this buffer is full the modem uses flow control to stop data from DTE. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data.

The \Q - \Q3 commands affect both DTE and DCE flow control.

The \Q4 - \Q7 commands affect only flow control by the DCE.

The \Q command disables flow control bilaterally.

When the \Q1 command is used, the modem generates and accepts XON/XOFF characters to start and stop the data flow. These characters have the same parity as the DTE setup taken from the last AT command.

When the \Q2 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it.

When the \Q3 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it. The DTE uses RTS off to stop data from the modem and RTS on to restart it.

The \Q4 command disables flow control by the DCE.

The \Q5 command enables XON/XOFF flow control by the DCE only.

The \Q6 and \Q7 commands force the modem to use RTS off to stop data from the modem and RTS on to restart it. This does not effect DTE flow control.

Command	Operation
\Q	Disable bilateral flow control
\Q1	Enable bilateral XON/XOFF flow control *
\Q2	Enable DTE CTS flow control, disable DCE flow control
\Q3	Enable CTS/RTS bilateral flow control
\Q4	Disable DCE flow control
\Q5	Enable DCE XON/XOFF flow control *
\Q6	Enable DCE RTS flow control
\Q7	Enable DCE RTS flow control

\* default

### XON/XOFF Pass Through \X

This option is active when flow control of the modem by the DTE has been selected for XON/XOFF and the connect mode is MNP-only or normal. It enables or disables the sending of local flow control characters (XON/XOFF) to the remote modem as well as being acted on in the local modem. In MNP-only mode the modem treats incoming XON/XOFF characters from the remote modem as data characters. In normal mode the modem will look at the \G command and act accordingly.



#### Caution

*With \X1 in effect local flow control characters will be sent to the remote system. These characters may turn on the data flow from the remote system before the modem is ready to receive more data, possibly resulting in data loss.*

Command	Operation
\X	Process but do not pass XON/XOFF characters to remote DCE *
\X1	Process and pass XON/XOFF characters to remote DCE

\* default

**Data Link Flow Control \G**

This flow control paces data from the remote modem to the local modem during a normal connection. When the \G1 command is sent, the modem uses XON/XOFF to start/stop data transmission from the remote modem. This command is ignored during an MNP connection.

Command	Operation
\G	Disable data link flow control *
\G1	Enable data link flow control

\* default

**Note**

*The V.3400 will transmit the XON/XOFF characters to start/stop data transmission from the remote modem. The V.3400 will not respond to the XON/XOFF characters. This is to insure that a false XON/XOFF is not detected resulting data loss.*

**Break Control \Kn**

Use \Kn ( $n = 0-5$ ) to indicate the action taken by the modem when a break is encountered.

Command	Operation
\K	Break option 0
\K1	Break option 1
\K2	Break option 2
\K3	Break option 3
\K4	Break option 4
\K5	Break option 5 *

\* default

Conditions under which breaks may occur are explained below with descriptions of the modem's response under the different \K command break options.

A break is sent to the serial port while the modem is in *connect state* during an *reliable* or *normal connection* (no protocol, data buffered).

<b>Command</b>	<b>Operation</b>
\K, \K2, \K4	Enter command mode but do not send break to the remote modem
\K1	Empty the data buffers and send break to the remote modem
\K3	Immediately send break to the remote modem
\K5	Send break to the remote modem in sequence with any data received from the serial port

A break is sent to the serial port while the modem is in *connect state* during a *direct connection* (no protocol, data not buffered).

<b>Command</b>	<b>Operation</b>
\K, \K2, \K4	Immediately send break to the remote modem and enter command mode when break is through
\K1, \K3, \K5	Immediately send break to the remote modem

A break is received from the remote modem while the modem is in *connect state* during a *normal connection* (no protocol, data buffered).

<b>Command</b>	<b>Operation</b>
\K, \K1	Empty the data buffers and send break to the serial port
\K2, \K3	Immediately send break to the serial port
\K4 , \K5	Send break to the serial port in sequence with any data received from the remote modem

A transmit break command is issued while the modem is in *command state* during a *reliable* (protocol) or *normal connection* (no protocol, data buffered).

Command	Operation
\K, \K1	Empty data buffers and send break to the remote modem
\K2, \K3	Immediately send break to the remote modem
\K4 , \K5	Send break to the remote modem in sequence with any data received from the serial port

### Inactivity Timer \T

The \T command specifies the number of minutes the modem will stay online without transmitting or receiving data before hanging up. When the value is set to 0, the timer is disabled.

Command	Operation
\T	Disable inactivity timer *
\Tn	Set inactivity to n (n=1-255) minutes

\* default

### Maximum Reliable Block Size \A

The \A command sets the maximum transmit block size for MNP connections. Use this command to force the modem to transmit smaller blocks in an MNP connection. A smaller block size maximizes throughput when marginal line conditions are causing errors. The modem sends a block up to the size specified by the \A command.

Command	Operation
\A	Maximum transmit block size = 64 characters
\A1	Maximum transmit block size = 128 characters
\A2	Maximum transmit block size = 192 characters
\A3	Maximum transmit block size = 256 characters *

\* default

**Transmit Break / Set Break Length \B**

The \B commands tell the local modem to send a break signal to the remote modem. In all modes except direct, S79 determines the length of the break sent to the DTE by the modem receiving a break signal over the link. S79 may be set directly or via \Bn where n=1-255 in 20 ms increments. The default is 35 (700 ms).

Command	Operation
\B	Sends a break signal to the remote modem (does not modify S79) *
\Bn	Sets S79 to length of break desired; n=1-255 in 20 ms increments; default= 35 (700 ms)

\* default

**Set Auto-Reliable Buffer \C**

This determines whether or not a modem in reliable mode will buffer data received from a modem that is not in reliable mode during the 4 seconds in which the modems try to establish a reliable link. Use these commands when the modem is in the auto-reliable mode and is expected to process a call from a modem not in a reliable mode.

Command	Operation
\C	Disable auto reliable data buffer *
\Cn	Buffer data for 4 seconds or 200 characters

\* default

**V.42bis Data Compression %C**

The %C command determines application of data compression while running LAPM protocol.

Command	Operation
%C	Data compression disabled
%C1	Enabled on transmit and receive data *
%C2	Enabled on transmit data only (enhanced compression)
%C3	Enabled on receive data only (enhanced compression)

\* default



# Chapter 7

## Test Mode Operation

### GENERAL

Diagnostic tests are used to isolate faults in the communications path. Diagnostic tests will terminate after the period of time specified by *S18*. If *S18* is set to 0, the timer is disabled and tests will run continuously. Tests may also be terminated by the *&T* command. When in test modes without test pattern, issue the escape sequence +++ to return to command mode before terminating the test with the *&T* command.



#### Note

*Local analog loopback with or without test pattern is the only test available in protocol mode.*

### Test Categories

Diagnostic tests fall into two categories: those with test patterns and those without. Refer to Table 7-1.

**Table 7-1. Test Operating Mode Requirements**

Test	Offline	Online
LAL (Local Analog Loopback)	X	X
LAL/TP (Local Analog Loopback with Self Test)	X	X
LDL (Local Digital Loopback)		X
RDL (Remote Digital Loopback)		X
RDL/TP (Remote Digital Loopback with Self Test)		X
TP (Test pattern)		X



#### Note

*These tests do not apply to fax mode and should only be performed when the modem is configured for data operation.*

LDL, RDL, and RDL/TP tests are initiated after making an online data connection in normal or direct mode only. LAL and LAL/TP are initiated while in offline command mode. These tests can be initiated by AT commands or by using the LCD front panel SELECT TEST menus. Refer to Table 7-2.

**Table 7-2. Test Commands**

Command	Operation
&T	Terminate any test
&T1	Initiate local analog loopback test
&T3	Initiate local digital loopback test
&T4	Grant remote requested digital loopback *
&T5	Deny remote requested digital loopback
&T6	Initiate remote digital loopback test
&T7	Initiate remote digital loopback with test pattern
&T8	Initiate local analog loopback test with test pattern
%T	Transmit test pattern

\* default

### **Terminating a Test in Progress &T**

Tests can be terminated manually or automatically. The &T command terminates a test manually. The modem automatically goes to command mode during LDL, LAL/TP, and RDL/TP tests. Enter the &T command to terminate the tests.

For LAL and RDL, enter the escape sequence before the &T command to go to the command mode.

By preloading register S18 with 1 to 255, each test mode automatically times out after the specified number of seconds and exits back to the command mode. Loading S18 with 0 disables the auto timeout feature and the test will run continuously until manually terminated.

For example:

To Run the self test analog loopback test for 30 seconds

Enter ATS18=30&T8

The modem should respond with 000 after 30 seconds.

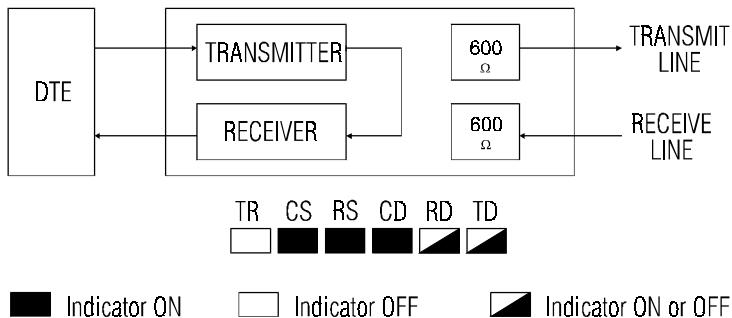
## TESTING THE LOCAL MODEM

Test local operation with the modem offline in command mode. Use LAL and LAL/TP to test the local modem and the communications to the local DTE.

### Local Analog Loopback &T1

In Local Analog Loopback the modem transmitter connects to its receiver so the analog signal normally sent over the telephone line is received locally.

If operating on leased lines, the lines are terminated into 600 ohms (Table 7-1). If off hook on a dial-up line, the modem is forced on hook.



---

**Figure 7-1 Local Analog Loopback  
(4-Wire Operation and 2-Wire Operation)**

For 2-wire operation, Analog Bilateral Loopback is invalid. In 4-wire operation, Analog Bilateral Loopback connects the receive line to the transmit line through a buffer amplifier.



**Note**

*Figures 7-1 through 7-5 include LED test indications. These indications are valid when DTE options are set by factory option set #1 and RTS is active from the DTE. Where indicated, RD and/or TD may be on, off, or flashing depending on the type of DTE and its operating state.*

Test the local DTE and cable by entering the &T1 command. Enter a test message and verify it is echoed on the screen. If the message is not returned exactly as entered, the terminal equipment or data cable is at fault.

To determine if the data cable is defective replace it with a properly configured cable with electrical continuity. If the cable checks out but the problem remains, the DTE is defective.

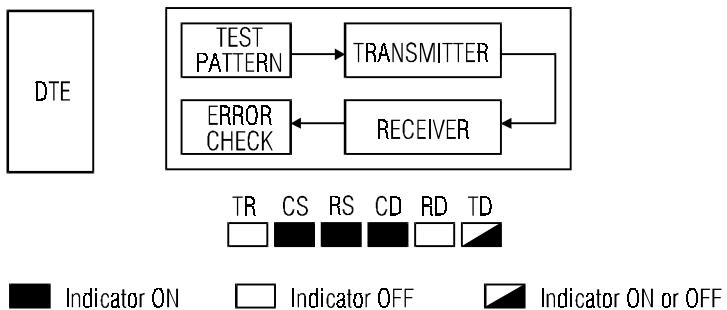
If all local equipment checks out, proceed to the Testing the Remote Modem section in this chapter.

Issue an escape sequence followed by &T1 to exit analog loopback.

**Local Analog Loopback with Self Test &T8**

When the modem is offline in command mode, enter the &T8 command to put the modem in self test local analog loopback (Table 7-2).

The modem transmits a test pattern. The test pattern is looped back to the receiver and checked for errors. Entering the &T command causes the modem to exit self test analog loopback. The modem responds with a three digit value between 0 and 255 representing the number of errors during test pattern detection. If errors occur, repeat the test to verify the consistency of the problem.



*Figure 7-2 Local Analog with Test Pattern*

### **TESTING THE REMOTE MODEM**

Use LDL, RDL, and RDL/TP in the online data mode to test the remote modem and phone line. Enter the escape sequence after making a connection to return to command mode. The appropriate test command, &T3, &T6, or &T7, can then be entered to initiate an online test.

#### **Local Digital Loopback &T3**

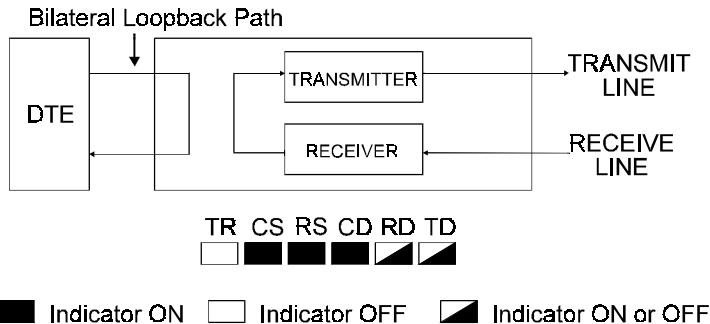
After making the data connection, enter the escape sequence to return to command mode. Entering &T3 puts the local modem in digital loop-back. The remote operator can now send a test message which is looped back to the remote terminal screen.

If the test timer (S18) was loaded before issuing the &T3 command the local modem exits the test after the specified number of seconds and returns to command mode. If not, enter &T to exit the test. Enter the command to return to online data mode.

The local modem receiver connects to its transmitter so received data is retransmitted to the remote site.

If Digital Bilateral Loopback is enabled locally, the local DTE is looped back to itself (Table 7-3). If disabled, the local DTE receives a constant mark.

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*Figure 7-3 Local Digital Loopback  
with Bilateral Loopback Enabled*

### **Grant/Deny RDL Request &T4, &T5**

Local operators can deny a request from the remote modem for remote digital loopback.

To      Allow your modem to be placed in RDL by a  
          remote operator

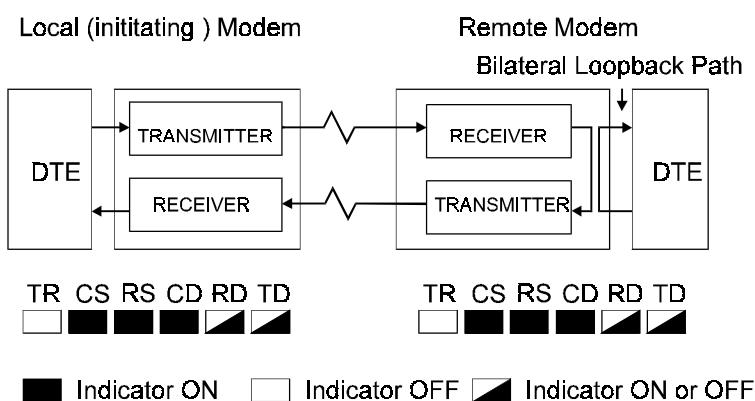
Enter    AT&T4

To      Prevent your modem from entering RDL

Enter    AT&T5

Remote Digital Loopback & T6

The initiating modem signals the remote modem to go to Digital Loopback. The remote modem receives and then retransmits data back to the local modem. If Digital Bilateral Loopback is enabled on the remote modem, the remote DTE is looped back to itself (Figure Table 7-4).



*Figure 7-4 Remote Digital Loopback with Digital Bilateral Loop Enabled at the Remote Site*

After making the data connection, enter the escape sequence to return to command mode. Entering &T6 places the remote modem in digital loopback provided the remote operator enters the &T4 command to allow an RL request. Enter a test message and verify the message is being looped back to your terminal screen. If the message is incorrect, use the analog loopback tests on both modems to isolate the problem. If both modems run analog loopback without errors, the problem could be with the phone line.

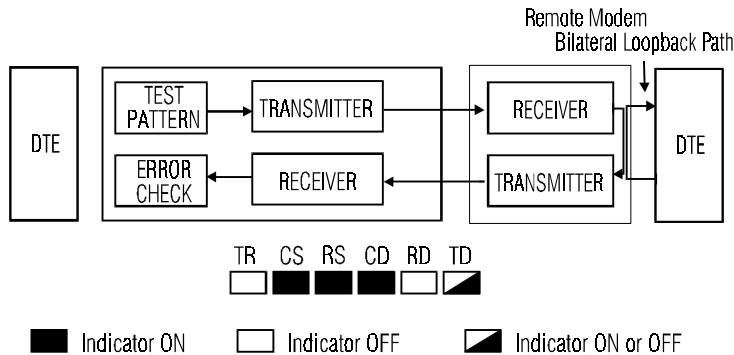
## Remote Digital Loopback with Self Test & T7

After making the data connection, enter the escape sequence to return to command mode. Entering &T7 places the remote modem in digital loopback provided the remote operator enters &T4 to allow an RL request. Once in RDL/TP, the local modem transmits a test pattern and

automatically verifies that the remote modem is looping the pattern back (Table 7-5). Enter &T to exit RDL/TP and return to command mode. Enter the O command to return online in data mode.

Exiting RDL/TP the modem responds with a three digit value between 0 and 255 representing the number of errors which occurred during test pattern detection. If errors occurred repeat the test several times to verify the consistency of the problem, then use the analog loopback tests to isolate the problem.

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**Figure 7-5 Local Modem Initiating Remote Digital Loopback with Test Pattern**

### **Test Pattern %T**

In Test Pattern, transmit data from the local DTE is blocked and replaced by a V.52 compatible test pattern. When the modem transmits the test pattern, it expects to receive the same pattern.

**Bilateral Test Enable / Disable \*DG**

Enable or disable bilateral test functions.

Command	Operation
*DG	Bilateral digital loop disabled *
*DG1	Bilateral digital loop enabled

\* default

**DTE Controlled Remote Digital Loopback (Pin 21) \*RD**

To enable DTE controlled remote digital loopback, enter \*RD1.

Enabled, the modem goes into remote digital loopback when it detects an off-to-on transition of pin 21 while in the online data mode. Test ends when it detects an on-to-off transition of pin 21 and then returns to online data mode. To disable this function enter the \*RD command.

Command	Operation
*RD	Ignore pin 21 *
*RD1	RDL enabled (pin 21)

\* default

 **Note**

If the test timeout option is enabled and pin 21 remains high, the modem returns to online mode at the end of the test timeout period and will not re-enter the test mode until an off-to-on transition of pin 21 is detected.

**DTE Controlled Local Analog Loopback (Pin 18) \*LA**

To enable DTE controlled local analog loopback test, enter \*LA1.

Enabled, the modem goes into local analog loopback when it detects an off-to-on transition of pin 18. Test ends when it detects an on-to-off transition of pin 18. To disable, enter \*LA.

Command	Operation
*LA	Ignore pin 18 *
*LA1	LAL enabled (pin 18)

\* default

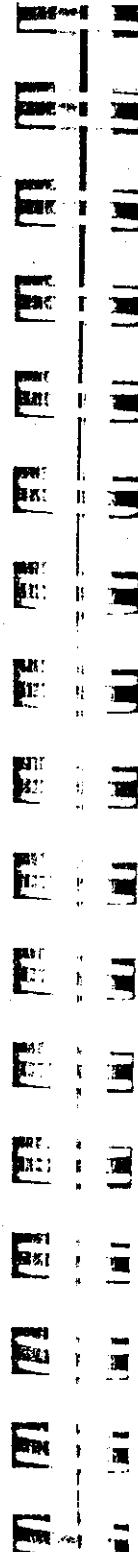


**Note**

*If the test timeout option is enabled and pin 18 remains high, the modem returns to idle mode at the end of the test timeout period and will not re-enter the test mode until an off-to-on transition of pin 18 has been detected.*

 **Note**

If the test timeout option is enabled and pin 18 remains high, the modem returns to idle mode at the end of the test timeout period and will not re-enter the test mode until an off-to-on transition of pin 18 has been detected.



**Chapter 8  
Security**

**GENERAL**

The V.3400 series of modems provide three features to assure secure operation of the modem. These features are front panel password protection, autocallback, and secure mode of operation. The topic of front panel password protection is discussed in Chapter 4.

Two levels of major security operation are available: high and low. The AT commands for each level are explained below.

**AUTOCALLBACK SECURITY**

Autocallback is an additional security feature that is separate from Low and High Security. Autocallback forces an answering modem to dial the selected autodial (\*AU<sub>n</sub>) telephone number after answering a call, holding the line for one second, and then disconnecting. When autocallback is enabled the modem will not train on a direct call. Access autocallback via Main Menu #5 on the LCD. Refer to Chapter 4 for further information. S72 enables/disables autocallback. S78 determines the delay in seconds before autocallback is initiated.

**LOW SECURITY OPERATION**

Low security operation provides password protection against unauthorized dial-up access. High security is another feature which is discussed later in this chapter. The security feature can be enabled/disabled with AT commands when operating on a dial-up system.

Transmitted data and received data lines are suppressed to the host DTE during security validation; all other signals (CTS, DSR, RI, etc.) operate as selected. After the password has been validated, the modem operates normally.

**Operating without Low Security**

The modem is not factory set for security and operates like a standard V.34, except for additional AT command which allow access to security. With these commands a user can set passwords and turn security on. When security is enabled, a password must be used to change security options.

## Operating with Low Security

A secure modem will not allow data transfer between its host and a remote host until a correct password is received from the calling party. If an incorrect password is received the secure modem disconnects. The front panel is not locked out because this type of security prevents unauthorized dial-up access.

## Remote Operation

The originating modem must transmit the correct security code before the secure modem will allow data transfer. If accessing a secure remote modem, the local modem prompts the user with

**PLEASE ENTER YOUR PASSWORD =>**

To      Respond to the password prompt  
Enter    AT\$ followed by the password.

After receiving the \$ the secure remote modem accepts the security code and waits for a carriage return. Entering more than ten characters is invalid and causes the secure modem to disconnect. Entering a valid password causes the calling party's DTE to display **PASSWORD ACCEPTED**.

## Local Operation

When accessing the local modem, the password is not required except when the user wants to change a security option. To change a password or to turn security on or off, the user must enter a password when entering the appropriate AT commands. EIA-232 signals to the DTE are not affected by security in command mode.

## Passwords

Two passwords of up to ten characters each can be stored in the modem's nonvolatile memory. AT commands change the passwords. Backspace and escape keys are not supported for password entry. The passwords can consist of any printable characters except a dollar sign, comma, or space. Passwords are case sensitive.

The passwords have the same priority level and are interchangeable with each other. This can be helpful in situations such as when the user forgets one of the passwords.

## LCD Indication of Security

The front panel LCD indicates whether security is on or off. If disabled, the LCD appears as if the security does not exist. If enabled, Main Menu #1 consists of the following display:

**SECURE 28800  
XXXX**

## Restrictions in Security Operation

If the caller gives the wrong password, while security is enabled, the modem will disconnect.

## LOW SECURITY COMMANDS

The following AT commands operate low security:

### Set Password **\$S=x**

The **\$S=x** command sets an empty password location to *x*. This command only applies when no password or only one is stored in memory. It can not be used to change a password.

### Changing a Password **\$C=x, y**

The **\$C=x, y** command changes either password where *x* represents the old password and *y* is new one.

### Deleting a Password **\$C=x, -**

The **\$C=x, -** command deletes password *x* from memory. Security is automatically disabled if the last password is deleted.

### Security Reset **\$DR**

This command resets security to its initial state (off with no passwords stored). The option is not available in remote configuration.

### Disabling Security **\$D=x**

The **\$D=x** command disables security where *x* is either password.

**Security Status \$D?, \$E?**

The \$D? or \$E? commands display the current status of security (on or off).

**Enabling Security \$E=x**

The \$E=x command enables security where x is either password.

**HIGH SECURITY****Compatibility**

The calling modem does not require any security capabilities to connect with a secured V.3400. Access to the V.3400 host is gained by following the appropriate logon procedure as described in following text. All security operations are controlled by the secured V.3400.

**Capacity**

The modem stores in nonvolatile memory the password, security level, callback phone number, and status information for 50 users.

**Operating without High Security**

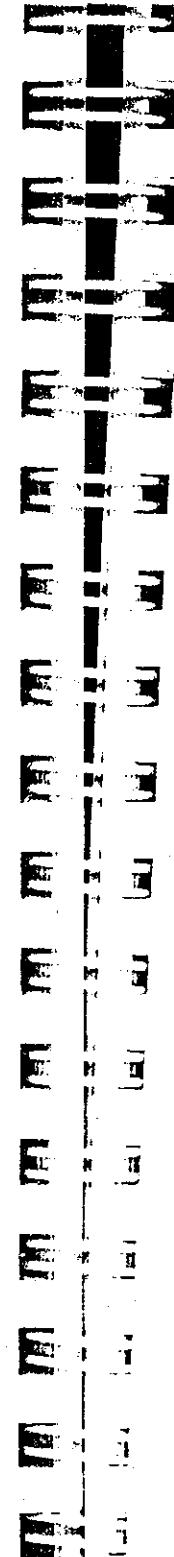
The modem is factory set with security disabled. In this mode the local DTE is connected to the local modem as usual except that the command to enable or view the status of the security feature will be accepted and processed.

**Operating with High Security**

With high security enabled, each user must follow the appropriate logon procedure. The procedure for remote users is determined by their assigned security level. Upon termination of the connection, the secured modem waits for the next call and password sequence. A local user must logon to the secured V.3400 to use the unit.

If a power outage occurs the logged on user must logon again when the power is restored.

For optimum security operation a reliable connection should be used.

**SECURITY LEVELS**

The V.3400 provides three levels of security to prevent unauthorized access by a remote user.

**Level 1: Password Only**

This is the lowest level of dial-up security. The user is prompted for an ID and password; if invalid, the modem hangs up.

**Level 2: Password with Callback**

This security level also requires that the user call from a pre-set telephone number. After the user enters a correct ID and password, the modem looks up the telephone number and calls the user back at that number.

**Level 3: Password with Callback and Password Re-Entry**

This is the highest level of security and is similar to Password with Callback except that after the user answers the callback call, the modem prompts him again for the password.

**SUPERUSER**

The superuser has access to all user information for administrative purposes and can change user logon requirements and privileges.

Superuser status can be gained at the local modem or from a remote Motorola or UDS modem via remote configuration, if the "Remote Superuser" option is enabled.

The superuser must first logon as a regular user, then request the superuser privilege.

Incorrect attempts to gain superuser privilege are logged in the users status information field in nonvolatile memory. After seven invalid attempts, the user is suspended from access to the V.3400 until cleared by the superuser.

To reinstate a suspended user, logon as a different regular user, then request superuser privilege in order to clear the illegal attempts count.

If the local superuser disables security, the only security commands available are those used to enable security or to check security status.

## Passwords

Passwords can be changed or deleted by the superuser. The regular user can change his password only if the "user changes" option has been enabled by the superuser. Refer to the Extended Features section for more details.

When calling from a remote location, the user is prompted for a password. Once the password is entered, the user is either allowed direct access or disconnected and called back depending on the assigned security level.

During password entry or logon, each password character is displayed as an "X" on the DTE screen. The backspace key can be used for editing. For remote logon, the Esc key can be pressed prior to the carriage return to clear the password entry.

Incorrect password attempts exceeding the threshold set in S77 for a specific user will cause the modem to disconnect. Each call exceeding the threshold increments the ILLEGAL ATTEMPTS counter by one. After seven calls the ILLEGAL ATTEMPTS counter will have reached maximum and the user will be suspended.

## Default Passwords

The modem is shipped from the factory with a default password for the superuser and for one regular user. They are

- SUPERUSER System administrator
- USER 1 User number 1

Passwords for users 2 through 50 are left blank.

It is recommended that the superuser change the default SUPERUSER and USER 1 passwords as soon as possible.

## HIGH SECURITY COMMANDS

These commands are only allowed for a local superuser.

### Enabling High Security \$EH=pw

The \$EH=pw command enables high security, where pw is the superuser's password.

To initialize high security for the first time enter

**AT\$EH=SUPERUSER**

to enable security, then enter

**AT\$I=USER1 <CR>** followed by  
**AT\$S=SUPERUSER <CR>**

to gain superuser status. Passwords, security levels, and callback numbers can now be entered or modified.

When superuser activities are completed, return to regular user status by entering AT\$. Once in regular user status AT\$ becomes the final local logoff command.

### Disabling High Security \$D

Enter the \$D command to disable security. The modem will operate as a nonsecure unit except that it will respond to enable and check security status commands.

### Setting Passwords \$Pn=pw\$pw

Select a password between 4 and 34 printable ASCII characters.

To store the password enter:

**AT\$Pn=pw\$pw**

Where n is the user number (0-50) and pw is the new password which is entered twice to ensure that it has been entered correctly.

The \$ character is used as the marker between the dual password entries and cannot be used as part of the password.

Passwords cannot be recalled from nonvolatile memory.

**Note**

*Superuser password is critical because the security feature cannot be configured without it.*

After logon as USER 1 and gaining superuser privileges, enter the \$Pn command to modify passwords.

For the superuser enter:

AT\$P0=pw\$pw

For user 1 enter:

AT\$P1=pw\$pw

Record the passwords in your personal records.

**Caution**

*Do not forget the superuser password. Systems administrator functions cannot be accessed without it and the modem must be returned to the factory for re-initialization.*

**Set Security Levels \$Ln=m**

The System Administrator (superuser) assigns each user with a security level by entering the \$Ln=m command (where n is the user number and m is the security level).

**Set User Callback Number \$Cn=m**

The callback number, used with level 2 or 3 security, is dialed by the modem after a user has successfully called in from a remote location and entered their password.

Level 1 security does not require a callback number; however, if the security level is changed to level 2 or 3 a callback number will be required.

The callback number should be programmed initially using the \$Cn=m command. Where n is the user number and m is the callback number.

**Extended Features \$W****\$W1**

A regular user can change his password and callback number if the local superuser has enabled the \$W1 option.

**\$W2**

A remote regular user can gain superuser privilege once the local superuser has enabled the \$W2 command.

**\$W0**

The extended feature options can be cleared by a local superuser by entering the \$W0 command.

**Display Extended Feature Status \$W?**

Enter the \$W? command to display the status of the user changes and remote superuser options.

**Display / Reset Illegal Access Attempt Counters \$M, \$Mn, \$M\***

This command informs the superuser of any illegal attempts to gain superuser status and the users current status. The status will either be "normal," indicating the user is still able to logon to the secure V.3400, or "suspended," indicating that the user made more than seven illegal attempts to gain superuser status and has been automatically suspended.

When the superuser logs on, the secure V.3400 automatically displays any illegal attempts since the last superuser logon. If it is not reset, the illegal attempt count will remain and the superuser will not be reminded unless more illegal attempts occur. To manually request this same information enter

AT\$M

The V.3400 responds by scrolling any illegal attempt information onto the screen as in the following example:

USER NUMBER: 01, ILLEGAL ATTEMPTS: 1,  
STATUS: NORMAL

USER NUMBER: 14, ILLEGAL ATTEMPTS: 7,  
STATUS: SUSPENDED.

OK

Enter the **\$Mn** command (where *n* equals user number) to reset a specific user's illegal attempt count.

Enter the **\$M\*** command to reset all of the user's illegal attempt count.

#### **Factory Reset \$F=pw\$pw**

To reinitialize the security feature enter the **\$F=pw\$pw** command (where *pw* is the "current" superuser password). This command deletes all user information and reinstates factory default passwords. User information cannot be recalled.

#### **Removing a User \$Rn**

This superuser command removes a user from active status without deleting all of the users information. The user can be restored to active status by setting the password with the corresponding user number as previously mentioned. The command to remove a user is

**AT\$Rn**

where *n* is the user numbers 2-50.

The superuser or user with ID #1 cannot be deleted from the user list.

#### **Security Status \$E?**

System security status can be verified using the **\$E?** command.

#### **Display User Status \$S?**

Enter the **\$S?** command to indicate whether or not the current user has superuser status.

The V.3400 responds with one of the following responses:

SUPERUSER STATUS  
NORMAL STATUS



#### **Verify User Information \$In, \$IBn**

Security level and callback number can be displayed using either the **\$In** or **\$IBn** command. To display the assigned security level and callback number for a single user enter

**AT\$In** where *n* is the user number.

A regular user can only check his own information. A user with superuser privileges can check any user's information.

A user with superuser privileges can also display the assigned security level and callback number for each valid user within a block of ten consecutive user numbers by entering:

**AT\$IBn** where *n* is the first user number.

#### **Request Superuser Privilege \$S=pw**

Once logged on as a user, superuser privilege can be requested by entering the **\$S=pw** command, where *pw* is the superuser password.

When the correct password has been entered, the V.3400 responds with

SUPERUSER STATUS

OK

#### **Local Logon Command \$n=pw**

Enter the **\$n=pw** command to logon locally to the secure V.3400. Where *n* is the user number and *pw* is the password.

#### **Local Logoff Command \$\$**

To logoff after a local session enter

**AT\$\$**

#### **Remote Logon Procedure \$n=pw**

The remote logon procedure is required to access a secure V.3400. When calling into the secure V.3400 from a remote location the user is prompted to enter a password. The password must be entered as

# **Chapter 9**

## **Fax Operation**

### **GENERAL**

The V.3400 can send and receive fax documents at speeds up to 14400 bps when used with the appropriate software. As a fax modem, the modem conforms to EIA-578 which defines a standard interface between the DTE (a PC with fax software) and the DCE as a fax modem.

When used with a Class 1 fax software package, V.3400 is CCITT Group 3 compatible and can send and receive documents at 2400, 4800, 7200, 9600, 12000, or 14400 bps with any Group 3 fax machine or PC with a fax modem.

Service Class selection configures the modem for Class 0 data mode or Class 1 fax mode. The LCD display indicates when fax mode is enabled. The V.3400 default configuration is for data mode; Service Class is normally only changed by the software as necessary.

Previous chapters in this manual contain information about the modem that should be understood prior to fax operation. Those chapters should be read before this chapter.

Users should understand the fax software manual before attempting fax communications.

### **FAX OPERATION**

The user's manual for the Class 1 fax software package should provide most information necessary to configure the software and send and receive faxes.

The information in Chapter 2 of this manual should be considered as well, and also the next section of this chapter provides important information for proper fax communications.

## **MODEM INITIALIZATION**

For fax operation, most fax software packages are equipped with a fax initialization command string. Entering this command sets the active profile for fax operation. In some cases certain options should be modified for particular requirements. The fax software manual provides information about requirements.

## **FAX DEFAULTS**

Factory defaults along with the initialization command support fax operation. Some initialization commands include the default command &*F* and will reissue it for each fax operation. Users must be aware that some fax software packages do not include the default command or only issue the default command when the fax software is first loaded. Subsequent fax operations may not reset the fax profile and if a fax required option has been changed by the user fax operation will not work.

An example of a fax initialization command is *AT&F V E S0=0*

This can be interpreted as:

- |                 |  |
|-----------------|--|
| <i>AT&amp;F</i> | Reset the active profile to the factory default. |
| <i>V</i>        | Set response messages to digit code.             |
| <i>E</i>        | Disable local echo (off).                        |
| <i>S0=0</i>     | Disable autoanswer (off).                        |

## **Fax Autoanswer**

Some fax software takes control of autoanswer, disables autoanswer for the modem, and answers the phone as internally programmed. Other programs do not control autoanswer at all and require the modem to have autoanswer enabled. The user must check the software manual for the particular requirements and refer to Chapter 4 for manual/autoanswer and TALK/DATA selection. Select the necessary options for fax operation.

## **FAX ASSOCIATED OPTIONS**

A number of options can be changed without any effect on fax operation. These include items like speaker volume and pause for carrier. Appendix E lists the AT commands and indicates how they may affect fax operation. These commands can be incorporated by personal preference into the initialization command. The user should compare fax operation requirements with Appendix A and if necessary generate an initialization command string compatible with the software and the modem.

## **Stored FAX Profile**

Another alternative is to develop a fax initialization command and store it in one of the user defined profiles. Fax initialization would include the command that recalls that profile for fax operation. The user must keep track of option changes between fax transmissions and if required reset the fax profile for the next fax transmission.

## **CLASS 1 DETAILS**

Operation as a fax modem complies with EIA-578; details of Class 1 operation and compatibility are found in that standard. There is no need to be familiar with these details since they are handled by the Class 1 software package, but this section briefly summarizes some of them.

As a Service Class 1 facsimile DCE, the V.3400 provides the basic services required to support Group 3 facsimile operation. Support from a Class 1 facsimile DTE is required to implement the CCITT T.30 recommendations for fax document transmission and the CCITT T.4 recommendations for encoding fax images. Using software control the modem can

- connect calls
- generate messages
- detect waiting and silence
- transmit and receive data
- provide HDLC data framing, transparency, and error detection

The modem also filters data streams to and from the DTE in accordance with the Class 1 specification.

The Class 1 standard assumes a serial asynchronous DTE-DCE connection using EIA-232D (or CCITT V.24) circuits. EIA-232D circuits AB (signal ground), BA (transmitted data), and BB (received data) are required for fax operation, while additional circuits are optional. Refer to Chapter 2 for hardware installation and EIA-232D data interface information.

The modem uses inband unidirectional DC1/DC3 (XON/XOFF) flow control to match the DTE-DCE data rate to the line signaling rate (hardware RTS/CTS is optional). Since 1200 bps is the minimum rate needed to support T.30 Phase C data transfer using V.29 9600 bps, a serial port data rate of at least 19200 bps should be used with the modem. Since flow control is used, this rate should not be changed during fax operation. The modem detects the DTE-DCE data rate from the AT command prefix as described in Chapter 5.

## **CLASS 1 COMMANDS**

The commands in this section are normally issued by the fax software and not by the user. They are provided here for reference. While only the lower order 7 bits of each character are used for commands and parameters, Phase C data transmission or reception requires all 8 data bits. Therefore, a data format which uses 8 data bits should be used for fax mode.

### **Dial Command D**

The dial command *D*, described in Chapter 5, tells the modem to go off hook, dial, and begin call origination. For fax operation, set the modem for Service Class 1 operation before the dial command is issued; use the +FCLASS=1 command.

The dial modifier, except *R*, can also be used in fax mode. Depending on the *X* option selected, the modem will return the BUSY and NO DIALTONE result codes as appropriate. If the modem is in the online command state when a dial command is issued (e.g., a connection has already been established), the modem returns an ERROR result code. The NO CARRIER result code indicates that a connection could not be established (no carrier detected) within the number of seconds specified in status register *S7*, or the dial command has been aborted due to a character sent from the DTE.

After dialing the specified number in fax mode, the modem generates 1100 Hz CNG tones in accordance with T.30 while trying to detect either CED (answer back tone) or the HDLC preamble of the first T.30 frame. The CNG tones cease after detecting either of these two signals. To allow proper interaction with manually answered fax stations, detection of CED is not required. After detecting 1650 Hz (i.e., the HDLC preamble of the first frame), the modem enters V.21 Channel 2 receive state with HDLC framing and returns a CONNECT result code. This is because dialing in fax mode (*+FCLASS=1*) implies an initial *+FRH=3* command described later in this section.

### **Answer Command A**

The *A* command instructs the modem to answer the call. For fax operation, set the modem for Service Class 1 operation before the *A* command is issued; use the *+FCLASS=1* command.

If the modem is in the online command state when an answer command is issued (e.g., a connection is already established), modem returns an ERROR result code. Otherwise, it answers the call and generates a 2100 Hz CED (answer back) tone in accordance with T.30. The modem then enters V.21 Channel 2 transmit state with HDLC framing and returns a CONNECT result code. This is because answering a call in fax mode (*+FCLASS=1*) implies an initial *+FTH=3* command described later in this section. In accordance with T.30, to allow proper interaction with a manually originated fax call, the modem does not require detection of CNG before generating CED or entering HDLC transmit mode.

If the DTE sends a character while executing the answer command and before CED is completed, the call is released and the modem will send the NO CARRIER result code.

### **On Hook H**

In fax mode, the *H* command instructs the modem to stop any transmission and terminate the call by going on hook.

### **Off Hook H1**

The *H1* command instructs the modem to go off hook. In fax mode, this might be used when the user has used manual dialing to place a fax call. In this case, no CNG tones are generated and the initial *+FRH=3* is not implied; it must be explicitly issued by the software.

### **Class 0 Operation +FCLASS=0**

Setting the Service Class to 0 with the *+FCLASS=0* command sets the modem in data mode. This default setting is normally only changed by software if needed.

### **Class 1 Operation +FCLASS=1**

Setting the Service Class to 1 with the *+FCLASS=1* command configures the modem as a Class 1 fax modem. This command is normally only issued by the fax software if needed. When set, the LCD displays FAX CLASS 1 MODE.

### **Service Class Indication +FCLASS?**

The current Service Class setting can be determined with the *+FCLASS?* command. A 0 response indicates the modem is configured for data mode while a 1 indicates it is set for fax mode. This information text is preceded and followed by <CR><LF> in addition to being followed by an appropriate result code response.

### **Service Class Capabilities +FCLASS=?**

The available Service Classes can be revealed by the *+FCLASS=?* command. The modem responds with the information text 0, 1 (preceded and followed by <CR> <LF>), indicating that the modem supports both data communication and Class 1 fax operation.

### **Transmit Silence +FTS=(*Time*)**

The command *+FTS=(Time)* causes the modem to wait in silence for the specified amount of time and then send the OK result code to the DTE. The (*Time*) value is in 10 ms increments from 0 to 2.55 seconds. The modem aborts the command and sends an OK result code if the DTE sends an additional character, which is discarded, during the command execution. This command returns an ERROR result code if issued while the modem is on hook.

**Receive Silence +FRS=(*Time*)**

The command **+FRS=** causes the modem to listen for silence and report back an OK result code when the line has been silent for the specified amount of time. The (*Time*) value is in 10 ms increments from 0 to 2.55 seconds.

The modem aborts the command and sends an OK result code if the DTE sends an additional character, which is discarded, during the command execution. This command returns an ERROR result code if issued while the modem is on hook.

**Fax Transmit and Receive Modes**

The following commands instruct the modem to transmit or receive facsimile data with the designated modulation. Flow control, data buffering, and data filtering are used as appropriate, in accordance with the Class 1 specification. Each of these commands must be the last command on the command line.

Command	Description
+FTM=(MOD)	Transmit data with (MOD) carrier
+FRM=(MOD)	Receive data with (MOD) carrier
+FTH=(MOD)	Transmit HDLC data with (MOD) carrier
+FRH=(MOD)	Receive HDLC data with (MOD) carrier

The modem accepts one of the values listed in Table 9-1.

**Table 9-1. Modulation Values**

Value	Modulation	Speed
3	V.21 channel 2	300 bps
24	V.27 ter	2400 bps
48	V.27 ter	4800 bps
72	V.29	7200 bps
73	V.17	7200 bps
74	V.17	7200 bps *
96	V.29	9600 bps
97	V.17	9600 bps

**Table 9-1. Modulation Values (Continued)**

Value	Modulation	Speed
98	V.17	9600 bps *
121	V.17	12000 bps
122	V.17	12000 bps *
145	V.17	14400 bps
146	V.17	14400 bps*

\* with short train

The V.3400 returns an ERROR result code if any of the above commands are issued while the modem is on hook.

**Facsimile Transmit +FTM=(Mod)**

+FTM=(Mod) causes the modem to transmit data using the modulation and speed selected with the (Mod) parameter. For V.27 ter, V.29, and V.17 modulations, the modem first transmits the required training sequence (with echo protector tone). After it is appropriately configured for transmission, the modem returns the CONNECT result code and transmits constant 1 bits until data is received from the DTE. For additional information, consult the Class 1 specification.

**Facsimile Receive +FRM=(Mod)**

+FRM=(Mod) causes the modem to receive data using the modulation and speed selected with the (Mod) parameter. If the selected carrier is detected, a CONNECT result code is sent to the DTE; if a different signal is detected, the modem sends a +FCERROR (CONNECT ERROR) result code and returns to command mode. This command is aborted if the DTE sends any character to the modem other than DC1 or DC3 during this mode. For additional information, consult the Class 1 specification.

**HDLC Transmit +FTH=(Mod)**

+FTH=(Mod) causes the modem to transmit HDLC framed data using the modulation and speed selected with the (Mod) parameter. For V.27 ter, V.29, and V.17 modulations, the modem will first transmit the required training sequence (with echo protector tone). Configured for HDLC transmission, the modem transmits HDLC flags and returns the

CONNECT result code. HDLC flags will continue to be sent until the first byte of data is received from the DTE or until 5 seconds elapses with no data. For additional information, refer the Class 1 specification.

### **HDLC Receive +FRH=(Mod)**

The command *+FRH= (Mod)* causes the modem to receive HDLC framed data using the modulation and speed selected with the *(Mod)* parameter. If the selected carrier is detected, a CONNECT result code is sent to the DTE; if a different signal is detected, the modem sends a +FCERROR (CONNECT ERROR) result code and returns to command mode. This command will be aborted if the DTE sends any character to the modem other than DC1 or DC3 during this mode. For additional information, consult the Class 1 specification.

### **Test Supported Range of Values +FTx=? , +FRx=?**

The supported range of values for any of the fax transmit or receive commands can be determined with the *+FTx=?* or *+FRx=?* command where *x* is *M*, *H*, or *S*. The normal transmit and receive capabilities are interrogated with *+FTM=?* and *+FRM=?*, while the HDLC transmit and receive capabilities are interrogated with *+FTH=?* and *+FRH=?*. Since the modem can send and receive normal data or HDLC data at all valid speeds up to 14400 bps, the modem returns the information text 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146 for any of these four commands if *x* is *M* or *H*. For the commands *+FTS=?* or *+FRS=?* the modem returns the information text 0-255, indicating an allowed time interval from 0 to 2.55 seconds. The appropriate information text is always preceded and followed by <CR><LF> and followed by an appropriate result code response.

### **Class 1 Result Code +FCERROR**

If the modem detects any carrier or tone that differs from that specified in a *+FRM* or *+FRH* command, it sends the +FCERROR result code and returns to command state, allowing the DTE to attempt a recovery. The numeric form of this response is +F4.

### **Fax Auto Answer +FAA=**

The modem can be set up to automatically detect if a fax or data call is being answered. The command *+FAA=1* enables this function and *+FAA=0* disables it. This feature requires special support by the fax software package.

Command	Description
<i>+FAA=0</i>	Disable fax auto answer
<i>+FAA=1</i>	Enable fax auto answer

### **BINARY FILE TRANSFER**

Some Class 1 software packages may provide an option for transferring files between computers with fax modems, using a Binary File Transfer (BFT) standard. Although the received file is not a fax image, transmitting the file is similar to sending a fax. Since the modem allows T.30 error correction mode (with HDLC framing up to 9600 bps), fax mode can also be used for BFT if supported by the Class 1 software package. The Binary File Transfer is an option in the fax software package, not a separate mode of operation.

## Chapter 10

# Status Registers

### S-REGISTERS

Most modem configuration information is stored in a part of memory called status (S) registers. During operation this information is used to determine modem functions.

The information stored in the S-registers can be changed by the AT or V.25 command sets and by pushbuttons in response to the LCD prompt. These are the preferred methods. Some software programs also access the S-registers via the AT command set, but this action is transparent to the user. The command indicates which memory bit(s) to alter to select a particular option or to perform a certain function. The S-register values comprise the configuration profile.



#### Caution

*The purpose of this tutorial is to show the versatility of option selection and register function. It is strongly recommended that the preferred methods of option selection be used. This tutorial uses S22 as the example register.*

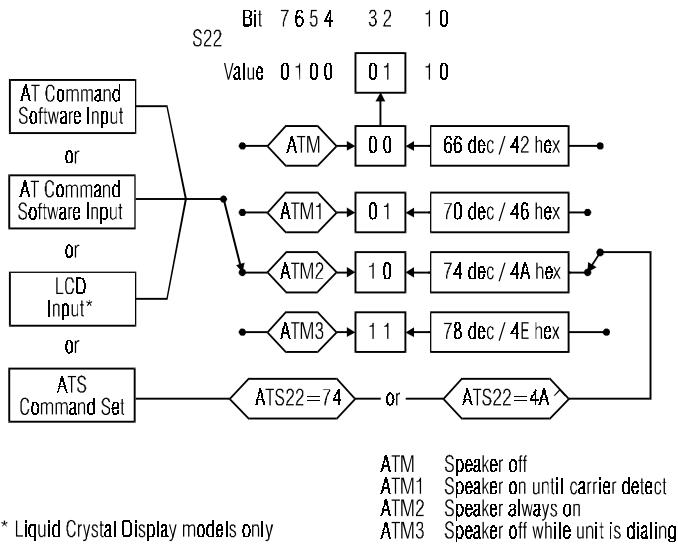
*Certain modems may use S22 differently or may not have an S22.*

Generally the user should not directly alter S-register values. However, the user has the option of entering S-registers via ATS commands and directly altering the register value. This is called "writing" to the S-register. Writing to an S-register is not a preferred method and should only be used by programmers who need to manipulate S-registers so they can interact with a software program under development or some other similar action.

Certain S-registers cannot be altered by the ATS command series. These are called "read only" S-registers. Appendix E contains a listing of S-registers and indicates if they are read only or read and write.

Figure 10-1 illustrates how the different inputs to an S-register (S22 in this case) are used to select a particular option. Bits 3 and 2 of S22 control speaker options. Some communication software packages may use the AT command set. For example purposes bit values are arbitrary.

Bit values for S-registers must not be confused with the total register value. Bit values are counted separately for each option group, called bit mapping, while the register value is the cumulative decimal or hexadecimal total. The decimal value counts all eight bits as a single group. Hexadecimal values split the bits into two groups of four each. Writing to an S-register changes the total value. Figure 10-2 illustrates the difference between decimal calculation and hexadecimal calculation.



**Figure 10-1 Changing S-Register Values**

---

Bit	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1
S22 Value	0	1	0	0	0	1	1	0
Decimal Total		64			+	4 + 2		= 70 dec
Hexidecimal Value	8	4	2	1	8	4	2	1
S22 Value	0	1	0	0	0	1	1	0
Hexidecimal Total	4			and .	4 + 2			= 46 hex

---

*Figure 10-2 Calculating S-Register Values*

### S-REGISTER OPERATION      **Sn?, Sn?^**

Enter *ATSn?* to read a register value, where *n*=register number for a decimal value; or *ATSn?^* for a hexadecimal value.

For example, to determine the current backspace character enter

AT5?

The screen will show the ASCII value of the backspace character stored in register *S5*.

### Changing Register Values      **Sn=v, Sn=^v**

To change an option using *ATS* commands requires the operator to precalculate the revised decimal (or hexadecimal) total. Because of the chance of miscalculating the bit sum, causing unplanned option changes, writing to an S-register is discouraged. For operators who prefer this method of option selection a much simplified command that eliminates the decimal calculation is explained in the *Individual Bit Command* section.

Enter  $ATSn=v$  to change a register value, where  $n$  = register number and  $v$  = decimal value; or  $ATSn=\wedge v$ , where  $\wedge v$  = hexadecimal value.

 **Note**

*Not all registers can be set by the  $ATSn=v$  (or  $\wedge v$ ) command.  
Some registers are for reference only.*

To change the escape character from + to the Esc key (ASCII value of 27)

Enter  $ATS2=27$

To return the modem to the command mode press the Esc key three times:

(pause) Esc Esc Esc (pause)

**Individual Bit Command  $Sn . \# =v$**

Some operators use AT commands as the primary method of changing S-register options. However, some options stored in registers do not have an associated AT command. For these options, the individual bit AT command can be used to change the setting of the bit controlling the option.

To change a single bit value within a register

Enter  $ATSn . \# =v$

where  $n$  = register number  $\#$  = bit position 0 through 7  $v$  = bit value 1 or 0

Example:

S-register 27, bit 2 selects between dial-up or leased line operation.

AT command method:

$AT&L$  selects dial-up operation (sets S27 bit 2 to 0)

*AT&L1* selects leased line operation (sets S27 bit 2 to 1)

Individual bit method:

*ATS27.2=0* selects dial-up operation (sets S27 bit 2 to 0)

*ATS27.2=1* selects leased line operation (sets S27 bit 2 to 1)



### **Note**

*This way of selecting options can be used on all S-registers except read only registers.*

### **Autoanswer S0**

This register turns the option on or off. Set the register to 0 to turn autoanswer off.

Set the register to any value other than zero (1-255) to turn autoanswer on. The number selected is the ring count the modem answers on. For example, if S0 equals 4, the modem answers the call on the fourth ring. The default value is 1.

### **Ring Count S1**

This register contains the ring count for a current incoming call and should not be changed. If developing communications software, the program can read the register to determine the ring total.

### **Escape Character S2**

The standard escape character is a + sign (ASCII value of 43). To change the character, set S2 to the desired ASCII value (0-255).

To disable the escape command, set S2 to any value greater than 127.

### **End-of-Line Character S3**

The standard end of line character is the carriage return (ASCII value of 13). This character ends each command as it is sent to the modem. It is also sent by the modem after each status message or number code.

To change the character, set S3 to the desired ASCII value (0-127).

### **Line Feed Character S4**

The standard character is the line feed (ASCII value of 10). This character is sent by the modem after each status message. To change it, set *S4* as desired (0-127).

### **Backspace Character S5**

The standard character is the backspace (ASCII value of 8). To change it, set *S5* to the desired value (0-127).

### **Pause Before Dialing S6**

When dial tone detection is disabled (command *X*, *X1*, or *X3* in effect), the modem waits the number of seconds (0-255) stored in this register before dialing. The default value is 2 (seconds).

### **Pause for Ringback and Carrier Detection / Wait for 2nd Dial Tone S7**

If no ringback is detected in the number of seconds in *S7* (1-255), the modem disconnects and sends the NO CARRIER message or code. If ringback is detected, the modem begins to look for a carrier.

If no carrier is detected within the number of seconds in *S7*, the modem hangs up and sends the NO CARRIER message or code.

Values between 1 and 255 may be used. The default value is 30 (seconds).

### **Pause Interval for Comma S8**

When a dial command contains a comma, the modem pauses the number of seconds in *S8*.

Change *S8* to change the basic pause interval (0-255), or use several commas in a row for greater delay during dialing.

The default value is 2 (seconds).

### **Carrier Detect Time S9**

*S9* contains the amount of time (0-255) in 0.1 second increments the carrier must be present to be recognized. The default value is 6 (0.6 second). This timer can be extended to lessen the likelihood of false detection of carrier.

**Lost Carrier Detect Time S10**

*S10* contains the amount of time (0-255) in 0.1 second increments carrier must be absent to be recognized as a loss of carrier. The default value is 14 (1.4 seconds).

**DTMF Tone Duration S11**

*S11* determines the length of DTMF tones. The period of silence is equal to the duration of the tone. The value of this register must be entered in multiples of 10. Default value is 80 (80 ms).

**Escape Sequence Pause S12**

Using the escape sequence to return to command mode from data mode requires two pauses, one before and one after the escape characters.

The pauses prevent the modem from responding to a character sequence which might contain the escape sequence as part of its normal data transmission.

*S12* contains the pause interval in 0.02 second increments. The factory setting is 50, equivalent to 1 second ( $50 \times 0.02$  sec). When *S12* is 0 then timing is not a factor.

The timing between the 3 escape characters must be less than the pause interval or the escape sequence will not be detected. The data rate also affects the timing and must be taken into account when changing the pause interval.

To disable the escape command, set *S2* to a value greater than 127 instead of changing *S12*. Values between 15 and 255 may be used for *S12*.

 **Note**

*When S-registers have parallel AT commands, the commands are listed in the register tables as a cross reference. If no command exists for the option the column is left blank.*

**S13**

Not used

**Bit Mapped S14**

Bit	Value	Command	Description
0	---	---	Reserved
1	0 1	E E1	Local character echo off Local character echo on *
2	0 1	Q Q1	Response messages on * Response messages off
3	0 1	V V1	Response messages as digit codes Response messages as words *
4	0 1	Q2	Ignore * Response messages in originate mode only
5	0 1	T P	Tone dial * Pulse dial
6	0 1	H2 --	Normal hang up * Not used
7	0 1	*OR1 *OR	Forced answer Normal originate *

\* default

**Note**

*Registers that contain more than one option are called "bit mapped" registers.*

**S15**

Reserved

**System Tests S16**

This register contains the status of system test options.

Bit	Value	Command	Description
0	0 1		Analog loopback inactive Analog loopback in progress
1			Reserved
2	0 1		Digital loopback inactive Digital loopback in progress
3	0 1		Remote digital loopback requested by other modem inactive Remote digital loopback requested by other modem in progress
4	0 1		Remote digital loopback inactive Remote digital loopback in progress
5	0 1		Self test remote digital loopback inactive Self test remote digital loopback in progress
6	0 1		Self test analog loopback inactive Self test analog loopback in progress
7			Reserved

**S17**

Not used

**Test Timeout S18**

The amount of time, in 1 second increments, that a diagnostic test will run is determined by the value assigned to S18 (0-255). A value of 0 disables the timer allowing a test to run indefinitely. The default value is 0.

**S19, 20**

Not used

**Bit Mapped S21**

Bit	Value	Command	Description
6, 0	00 10 01 11	&S &S1 &S2 &S3	DSR forced on * DSR on when online DSR off 5 seconds after disconnect DSR follows off hook (OH)
5, 1	00 10 01 11	&C &C1 &C2 &C3	DCD always on * DCD on while carrier present DCD on except for 5 seconds after disconnect DCD follows RTS on remote modem; not valid in reliable mode
2	0 1	&R &R1	CTS follows RTS by S26 delay CTS always on *
4, 3	00 01  10 11	&D &D1  &D2 &D3	Modem ignores DTR * Modem assumes command mode when DTR turns off  Modem hangs up when DTR turns off Modem resets when DTR turns off
7	0 1	Y Y1	Long space disconnect disabled Long space disconnect enabled *

\* default

**Bit Mapped S22**

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
1, 0	00 01 10 11	L L1 L2 L3	Speaker volume low Speaker volume low Speaker volume medium * Speaker volume high
3, 2	00 01 10 11	M M1 M2 M3	Speaker off Speaker on until carrier detect * Speaker always on Speaker off when modem is dialing
6-4	000 001 010 011 100	X X1 X2 X3 X4	CONNECT message only, blind dials, no busy detect CONNECT / appropriate code for rate, blind dials, no busy detect CONNECT / appropriate code for rate, waits for dial tone, no busy detect CONNECT / appropriate code for rate, blind dials, reports BUSY CONNECT / appropriate code for rate, waits for dial tone, reports BUSY *
7	0 1	&P &P1	Make / break ratio (US) 39/61 * Make / break ratio (UK) 33/67

\* default

**Bit Mapped S23**

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
0	0 1	&T5 &T4	Remote digital loop request denied Remote digital loop request granted *
5-1	---	---	Reserved
7, 6	00 01 10 11	&G &G1 &G2 --	No guard tones * 550 Hz guard tone 1800 Hz guard tone Not used

\* default

**S24**

Not used

**DTR State Recognition S25**

The S25 register specifies the amount of time (0-255) in 0.01 second (10 ms) increments that DTR must stay high or low in order to be recognized as such. The default value is 5 (0.05 second).

**RTS/CTS Delay S26**

The S26 register specifies the amount of time (0-255) in 0.01 second (10 ms) increments between the RTS signal and the CTS signal. The default value is 0.

**Bit Mapped S27**

Bit	Value	Command	Description
1, 0	00 01 10 11	&M &M1 &M2 &M3	Async * Sync data / async dial Sync data / dial through DTR Sync data / manual dial
2	0 1	&L &L1 and &L2	Dial-up line * Leased line
3	--	--	Reserved
5, 4	00 01 10 11	&X &X1 &X2 --	Internal clock * External clock Receive clock Not used
6	1 0		Enable async DTR dialer Disable async DTR dialer *
7	--	--	Reserved

\* default

**Lookback Timer S28**

The S28 register specifies the amount of time in 1.0 minute increments that the modem will remain in dial backup mode before retrying leased line mode. A zero will disable automatic lookback to leased line. The default value is 15 minutes.

Bit	Value	Command	Description
7- 0	0-255		Time in 1 minute increments (0=disabled)

**Bit Mapped S29**

Bit	Value	Command	Description
0	0	*NT1	Enable AT command set *
	1	*NT	Disable AT command set
1	0	*RO	Options retained at disconnect *
	1	*RO1	Options restored at disconnect
2	0	*FT	Disable V.32 fast train *
	1	*FT1	Enable V.32 fast train
6, 3	--	--	Reserved
7	0	*FB	DTE fallback disabled *
	1	*FB1	DTE fallback enabled

\* default

**Bit Mapped S30**

Bit	Value	Command	Description
0	--	--	Reserved
1	0		V.25 ASCII *
	1		V.25 EBCDIC
2	0		V.25 VAL enabled *
	1		V.25 VAL disabled
4, 3	--	--	Reserved
5	0		NRZ V.25 *
	1		NRZI V.25
7, 6	00	&M	V.25 disabled *
	01	&M4	V.25 bisync enabled
	10	&M5	V.25 SDLC enabled
	11	&M6	V.25 Async enabled

\* default

**S31**

Reserved

**Bit Mapped S32**

Bit	Value	Command	Description
0	0 1	&L1 &L2	2-wire (leased line only) * 4-wire (leased line only)
1	0 1	*LC1 *LC2	Line current disconnect = short Line current disconnect = long *
2	0 1	*LC *LC1 or *LC2	Line current disconnect = disable Line current disconnect = enable *
3	0 1	*DB *DB1	Dial backup = manual * Dial backup = automatic
7-4	--	--	Reserved

\* default

**S33**

Reserved

**Bit Mapped S34**

Bit	Value	Command	Description
0	0 1	*AN *AN1	Bilateral analog = disable * Bilateral analog = enable
1	0 1	*DG *DG1	Bilateral digital = disable * Bilateral digital = enable
2	0 1	*LA *LA1	DTE commanded LAL = disable * DTE commanded LAL = enable
3	0 1	*RD *RD1	DTE commanded RDL = disable * DTE commanded RDL = enable
7-4	--	--	Reserved

\* default

**DTR / Dial Backup Number to Dial S35**

Select the number to automatically dial (1-9 of stored numbers) for the modem to dial in DTR dialing or autodial backup.

**S36-S38**

Reserved

**Bit Mapped S39**

Bit	Value	Command	Description
0-4			Reserved
5	0	DCE	Connect MSG disabled *
	1	DCE	Connect MSG enabled
6-7			Reserved

\* default

**S40-S43**

Reserved

**XON Character from DTE S44**

Select the XON character (0-127) to be sent from the DTE. The default value is 17.

**XOFF Character from DTE S45**

Select the XOFF character (0-127) to be sent from the DTE. The default value is 19.

**S46-48**

Reserved

**XON Character to DTE S49**

Select the XON character (0-127) to be sent to the DTE. The default value is 17.

**XOFF Character to DTE S50**

Select the XOFF character (0-127) to be sent to the DTE. The default value is 19.

**S51**

Reserved

**Bit Mapped S52**

The S52 register selects leased line transmit level from 0 to -30 dBm in 1 dB increments.

Bit	Value	Command	Description
4-0	0 to 30	*TLn (n=0-30)	Transmit level in dB (0 through -30 dBm) *
7-5	--	--	Reserved

\* default

**Automatic Rate Adaption Threshold S53**

Bit	Value	Command	Description
1, 0	--	--	Reserved
3, 2	00 01 10 11	%R %R1 %R2 %R3	Automatic rate adaption threshold disabled * Low BER Medium BER High BER
4	--	--	Reserved
5	0 1		Protocol Neg status disabled * Protocol Neg status enabled
6-7	--	--	Reserved

\* default

**Flow Control S54**

The S54 register selects the flow control options.

Bit	Value	Command	Description
1, 0	00 01 10 11	\Q \Q1 \Q2 \Q3	Disable DTE flow control Enable DTE XON/XOFF flow control * Enable CTS flow control to the DTE Enable bilateral CTS/RTS flow control
2	--	--	Reserved
3	0 1	\G \G1	Disable modem port flow control * Enable modem port XON/XOFF flow control
4	0 1	\X \X1	No XON/XOFF characters to remote * Pass XON/XOFF characters to remote
6, 5	00 01 10 11	\Q4 \Q5 \Q6 \Q7	Disable flow control from DCE Enable XON/XOFF flow control * Enable CTS flow control to the DTE Enable CTS flow control to the DTE
7	--	--	Reserved

\* default

**S55**

Reserved

**V.42 Compression Control S56**

Bit	Value	Command	Description
1, 0	00 01 10 11	%C %C2 %C3 %C1	Compression disabled Compression enabled on transmit data only Compression enabled on receive data only Compression enabled on transmit and receive data *
7-2	--	--	Reserved

\* default

**Bit Mapped S57**

Bit	Value	Command	Description
0	0	*RC	Standard number codes * 15 - 4800 bps 18 - 9600 bps
	1	*RC1	Alternate number codes 11 - 4800 bps 12 - 9600 bps
4-1	--	--	Reserved
5	0 1		Busy out disabled * Busy out enabled during LAL test mode (for private PBX use only)
7, 6	--	--	Reserved

\* default

**Inactivity Timer S58**

The S58 register specifies the number of minutes the modem waits before terminating a call when no data is sent or received. This register is active when in error control mode. 0 disables timer. Issue the \Tn command to load inactivity timer, n=0-255 minutes.

Bit	Value	Command	Description
7-0	0 1-255	\T \T (n=1-255)	Disable * Timer value in minutes

\* default

**Break Control S59**

The S59 register determines the action taken when a break is encountered. Refer to Break Control section in Chapter 6 for further explanation.

Bit	Value	Command	Description
2-0	000	\K	Break option 0
	001	\K1	Break option 1
	010	\K2	Break option 2
	011	\K3	Break option 3
	100	\K4	Break option 4
	101	\K5	Break option 5 *
7-3	--	--	Reserved

\* default

**Bit Mapped S60**

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
0	0 1	%E %E1	Disable auto retrain Enable auto retrain *
1	0 1		MNP compression disabled MNP compression enabled *
2	0 1	\C \C1	Disable auto-reliable data buffer * Buffer data for 4 seconds or 200 characters
5- 3	--	--	Reserved
6	0 1	\R \R1	RI blinks for ring and remains on for duration of call RI blinks for ring and turns off when call is answered *
7	0 1	\V \V1	Disable protocol response messages * Enable protocol response messages

\* default

**DTE Options S61**

The *S61* register indicates the character size and parity. This register is for reference only.

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
2-0	--	--	Reserved
3	0 1		7 bit word length 8 bit word length
5, 4	00 01 10 11		Mark parity No parity Odd parity Even parity
7, 6	--	--	Reserved

\* default

**Disconnect Buffer Delay S62**

The *S62* register determines the delay before disconnect, to allow buffers to empty, when disconnect conditions exist.

Bit	Value	Command	Description
7-0	0	%D	Buffer disabled *
	1-255	%Dn	Disconnect buffer delay value (seconds)

\* default

**Maximum Transmit Block Size S63**

The *S63* register sets the maximum transmit block size.

Bit	Value	Command	Description
7-0	63	\A	Maximum block size = 64
	127	\A1	Maximum block size = 128
	191	\A2	Maximum block size = 192
	255	\A3	Maximum block size = 256 *

\* default

**Auto-Reliable Fallback Character S64**

The *S64* register stores the selected ASCII value of the auto-reliable fallback character.

Bit	Value	Command	Description
7-0	0	%A	Disable auto-reliable fallback character *
	1-127	%An	ASCII value 1-127

\* default

**S65-66**

Reserved

**Link Speed Status S67**

The S67 register indicates the true data link (DCE) speed. This register is for reference only.

Bit	Value	Command	Description
4-0	00000		N/A
	00001		300 bps
	00010		Reserved
	00011		1200 bps
	00100		2400 bps
	00101		4800 bps
	00110		7200 bps
	00111		9600 bps uncoded
	01000		9600 bps trellis
	01001		12000 bps
	01010		14400 bps
	01011		16800 bps
	01100		19200 bps
	01101		21600 bps
	01110		24000 bps
	01111		26400 bps
	10000		28800 bps
7-5	--	--	Reserved

\* *default*

**S68**

Reserved

**DCE Independent Speed S69**

The *S69* register selects the DCE independent rate operation. When *S69* is 0, DTE and DCE rates are equal and the maximum originate connect rate up to 14400 bps is determined by *S80*. When *S69* is non-zero, the maximum originate connect rate is determined by *S69*.

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
4-0	00000	%B	Use rate indicated by S80
	00001	%B1	300 bps
	00011	%B2	1200 bps
	00100	%B3	2400 bps
	00101	%B4	4800 bps
	00111	%B5	9600 bps uncoded
	01000	%B6	9600 bps trellis
	00110	%B7	7200 bps
	01001	%B8	12000 bps
	01010	%B9	14400 bps
	00010	%B10	Reserved
	01011	%B11	16800 bps
	01100	%B12	19200 bps
	01101	%B13	21600 bps
	01110	%B14	24000 bps
	01111	%B15	26400 bps
	10000	%B16	28800 bps *
7-5	--	--	Reserved

\* default

**Operating Mode S70**

The *S70* register determines the protocol operating mode and action taken on an MNP link attempt failure. LAPM is assigned highest priority.

Example: With \N7 selected the modem tries a LAPM connection first; if unsuccessful the modem tries an MNP connection; if also unsuccessful the modem connects in normal mode. Modes allowing protocol fallback are referred to as auto-reliable.

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
2-0	000	\N	Normal
	001	\N1	Direct
	010	\N2	MNP only (reliable)
	011	\N3	MNP or normal (auto-reliable)
	100	\N4	LAPM only (reliable)
	101	\N5	LAPM or normal (auto-reliable)
	110	\N6	LAPM or MNP only (auto-reliable)
	111	\N7	LAPM or MNP or native (auto-reliable) *
3	0	\M	Disable V.42 fast detect
	1	\M1	Enable V.42 fast detect *
7-4	--	--	Reserved

\* default

### Operating Mode Status S71

The S71 register indicates the level of error controlling protocol. This register is for reference only.

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
2-0	000		Protocol not active
	001		Protocol negotiation in progress
	010		MNP level 2 active
	011		MNP level 3 active
	100		MNP level 4 active
	101		MNP level 5 active
	110		LAPM active
	111		LAPM with data compression active
7-3	--	--	Reserved

\* default

**Bit Mapped S72**

Bit	Value	Command	Description
0	0 1	\J \J1	Disable slaved DTE/DCE (constant speed DTE on) * Disable slaved DTE/DCE (constant speed DTE on)
1	--	--	Reserved
2	--	--	Reserved
3	0 1	&R2	CTS does not follow DCD CTS follows DCD
6-4	--	--	Reserved
7	0 1		Disable autocallback * Enable autocallback

\* default

**Password Timeout S73**

The length of time the remote user has to enter a password before the secure V.3400 drops the call.

Bit	Value	Command	Description
7-0	0-255		Time in seconds (0 = disable)

\* default

**Callback Delay S74**

The length of time the secure modem waits to place the callback call after the remote user correctly enters a password and the call is dropped. Default is 15 seconds.

Bit	Value	Command	Description
7-0	0-255		Time in seconds (0 = disable)

**Callback Retry S75**

The number of times the modem will attempt to place the callback call to a remote user if the first attempt is unsuccessful.

Bit	Value	Command	Description
7-0	0-255		Number of attempts to place the call

**Callback Retry Delay S76**

The length of time that the modem waits, after an unsuccessful attempt to connect to the remote unit at the programmed callback number, before trying to place the call again. Default is 15 seconds.

Bit	Value	Command	Description
7-0	0-255		Time in seconds (0 = disable)

**Lockout Threshold S77**

The number of incorrect remote user password attempts that can be made before the call is dropped.

Bit	Value	Command	Description
7-0	0-255		Number of incorrect password attempts (0 = disable)

**Autocallback Timer S78**

The S78 register specifies the time in seconds that the modem waits before initiating autocallback. The default is 30 seconds.

Bit	Value	Command	Description
7-0	0-255		Time in seconds before autocallback

**Break Length S79**

The S79 register sets the length of the break sent to the DTE when a break signal is received. Range from 1-255 in 20 ms increments. Default is 35 (700 ms).

Bit	Value	Command	Description
7-0	0-255	\B \Bn	Send break Set break length ( $n=1-255$ )

**Serial Port Speed S80**

The S80 register indicates the serial port speed.

Bit	Value	Command	Description
4-0	00001		300 bps
	00010		600 bps
	00011		1200 bps
	00100		2400 bps
	00101		4800 bps
	00110		7200 bps *
	00111		9600 bps
	01000		12000 bps
	01001		14400 bps
	01010		16800 bps
	01011		19200 bps
	01100		21600 bps
	01101		24000 bps
	01110		26400 bps
	01111		28800 bps
	10000		38400 bps
	10001		57600 bps
	10010		115200 bps

\* *default*

**Minimum DCE Speed S81**

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
4-0	00000	%L	Disabled
	00001	%L1	Disabled *
	00011	%L2	1200 bps
	00100	%L3	2400 bps
	00101	%L4	4800 bps
	00111	%L5	9600 bps uncoded
	01000	%L6	9600 bps trellis
	00110	%L7	7200 bps
	01001	%L8	12000 bps
	01010	%L9	14400 bps
	00010	%L10	Reserved
	01011	%L11	16800 bps
	01100	%L12	19200 bps
	01101	%L13	21600 bps
	01110	%L14	24000 bps
	01111	%L15	26400 bps
	10000	%L16	28800 bps
7-3	--	--	Reserved

\* default

**S82-S87**

Reserved

**Modulation Type S88**

Bit	Value	Command	Description
3-0	0000		Auto mode
	0001		V.21
	0010		B103
	0011		Reserved
	0100		B212A
	0101		V.22 bis
	0110		V.27 (lease line only)
	0111		Reserved
	1000		V.29 (lease line only)
	1001		Reserved
	1010		V.33 (lease line only)
	1011		V.32 bis
	1100		V.34
7-4			Reserved

**S89-S90**

Reserved

**Current Modulation S91**

Bit	Value	Command	Description
3-0	0000		Auto mode
	0001		V.21
	0010		B103
	0011		Reserved
	0100		B212A
	0101		V.22 bis
	0110		V.27 (lease line only)
	0111		Reserved
	1000		V.29 (lease line only)
	1001		Reserved
	1010		V.33 (lease line only)
	1011		V.32 bis
	1100		V.34
7-4			Reserved

**S92 - S94**

Reserved

**V.34 Settings S95**

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
0	0		Disable V.8 for non-V.34 answer
	1		Enable V.8 for non-V.34 answer *
3-1	--		Reserved
4	0		Disable non-linear encoding
	1		Enable non-linear encoding *
5	0		Disable pre-emphasis
	1		Enable pre-emphasis *
6	0		Disable constellationshaping
	1		Enable constellation shaping *
7	0		Precoding disabled
	1		Precoding enabled*

\* default

**V.34 Settings S96**

<b>Bit</b>	<b>Value</b>	<b>Command</b>	<b>Description</b>
4-0	--		Reserved
5	0		Disable asymmetric bit rates
	1		Enable asymmetric bit rates *
6	--		Reserved
7	0		Disable TX power control
	1		Enable TX power control *

\* default

**S97 - S100**

Reserved



## Chapter 11

### V.25 bis Autodialer

#### GENERAL

V.25 bis is an option that allows dialing functions to be controlled using synchronous data.

Select V.25 bis through the appropriate  $\&M$  command in the AT command set (Chapter 5).

If using the LCD:

- Scroll through the menu to Main Menu 5, MODIFY CONFIGURATION.
- Advance to and enter the DTE PARAMETERS submenu.
- Select SYNC DATA.
- Advance to DIAL METHOD.
- Select either V.25 BISYNC DIALER or V.25 SDLC DIALER or V.25 ASYNC DIALER and then select either ASCII or EBCDIC character format.



#### Note

*The modem must be configured as V.25 SDLC ASCII NRZ for use with an AS400 IBM computer.*

#### Autodialer Command Strings and Parameters

Most command strings for the autodialer include two parts: the command itself and the parameter(s) that follow. For the purposes of this chapter, parameters can be telephone numbers or anything appropriate to V.25 bis as described in the following text. Parameters are separated by semicolons.

For example:

PRN a; nnn . . . n    where a = the phone number address in memory and nnn . . . n = the phone number

The a and the nnn . . . n are both parameters.

Not all commands have parameters. For example the CIC command has no parameter.

## GUIDELINES

Use the following guidelines when working with V.25 bis software:

- An indicator enclosed in less than/greater than signs represents a specific character in the appropriate character set, ASCII or EBCDIC.

<sp> - space

- Each response below is considered an individual message per V.25 bis conventions. A dial command with intermediate call progress enabled (BISYNC mode ASCII/EBCDIC character set) is illustrated:

From DTE

To DTE

```
<sy><sy><stx>CRN<sp>(205)555-0124<etx>
<sy><sy><stx>VAL<etb>
                                                <sy><sy><stx>CNX<sp>@9600BPS<etx>
```

- Spaces in a command from the DTE are optional and ignored.
- Command strings can be upper or lower case. Responses are always upper case.
- V.25 bis commands are implemented in the following data formats:  
ASYNC  
BISYNC  
SDLC NRZ  
SDLC NRZI  
in ASCII or EBCDIC

- The separator fields are data format dependent.

for ASYNC {sep} = command <CR>  
BISYNC {sep} = <sy><sy><stx>command <etx>  
SDLC {sep} = <Flags><Addr><ctl>command <FCS>

Where: <sy> = 16 hexadecimal  
<stx> = 02 hex  
<etx> = 03 hex  
<etb> = 17 hex  
<Flag> = 7E hex  
<Addr> = FF hex  
<ctl> = 13 hex (last frame), 03 hex (not last frame)  
<FCS> = Frame Check Sequence  
<CR> = Carriage Return

### **Invalid Responses Explanations**

Except when stated otherwise, the following explanations for invalid INV responses apply:

*INVCU* Any transmission error (parity, framing, etc.).

*INVMS* Receiving too many characters for any command.

*INVMS* Any command followed by a semicolon ;

*INVPS* This message has one of three possible meanings:

- Any parameter set ending with a semicolon ;
- Any parameter set containing too many or not enough parameters; this includes
  - any command entered without parameters that requires parameters
  - any command entered with parameters that does not require parameters.
- Any parameter containing too many characters.

*INVPV* This message has one of three possible meanings:

- Any parameter set containing invalid characters
- Any parameter or parameter set containing no valid (only ignored) characters
- Any parameter set containing an out-of-range parameter

## DIAL PARAMETERS

Table 11-1 lists and describes the parameters used in autodialing. The memory available for dialing can hold up to 40 characters. Parameters inserted for readability are not counted.

**Table 11-1. V.25 bis Dial Parameters**

Character	Function
0 thru 9	DTMF and pulse digit
* and #	DTMF digit
:	Wait for dial tone
W	Wait for 2nd type of dial tone
>	Pause for 1 second
=	Pause for 3 seconds
<	Pause for programmed delay time
P	Pulse dialing
T	Tone dialing
&	Flash (go on hook) for $\frac{1}{2}$ second
;	PARM separator
Space, dash, parenthesis, period	Parameters inserted for readability

## V.25 BIS COMMAND AND RESPONSE DEFINITIONS

The following sections describe the commands used with the V.25 bis autodialer and explain the responses received when each command is executed.

**Dial Command CRN nn...n**

The dial command is a *CRN* followed by the number to be dialed *nn...n*. The modem accepts up to 40 dial parameters, excluding the CRN command and any leading spaces.

Responses:

*VAL* Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

*INVCU* Invalid command - command unknown.  
Example: TRN (205)-555-0124

*INVMS* Invalid command - message syntax error.  
Examples: CRN;(205)-555-0124  
CRN; (semicolon invalid)

*INVPS* Invalid command - parameter syntax error.  
Examples: CRN (205)-555-0124  
CRN (205)-555;0124  
CRN

*INVPV* Invalid command - parameter value error.  
Examples: CRN (205)-555-012Q  
CRN

*CFIET* Call failure - reorder or busy.

*CFIRT* Call failure - timeout occurred.

*CFINT* Call failure - no answer back tone.

*CFIDT* Call failure - no dial tone.

*CFIAB* Call failure - ABT detected but no carrier.

*INC* Incoming ring detected.

### **Program Number Command PRN *a;nn...n***

The program number command is *PRN* followed by the one digit decimal address *a* and the number to be stored *nn . . . n*. Each address can store up to 31 dial parameters. Ignored characters in the dial number are not stored. Nine stored numbers are available at addresses 1-9.

Responses:

Same as for the *CRN* command except for call progress responses.

### **Intermediate Call Progress Response**

The following response is given only if enabled. See Option Definition 002 below.

*CNX@nnnnnBPS* - where *nnnnn* is the line speed. This connect response appears after handshake completed, but before DSR is activated. This response is required if the intermediate call progress option is enabled.

### **Dial Stored Number CRS *a***

The command for dialing a stored number is *CRS* followed by the one digit address *a* for the stored number to be dialed.

Responses:

Same as for the *CRN* command plus

*CFINS*      Call failure - number not stored.

If the number is linked with other numbers, via a *PRL* command, failure responses are returned as

*{sep}a;{call progress messages} . . .*

where *a* is the address dialed, followed by the separator field and call progress messages (*CFI*, etc.).

If the call fails to connect and the number is linked with other numbers, the autodialer tries to call the next number in the list of linked numbers.

**Request List of Stored Numbers RLN**

The request list of stored numbers command is an *RLN*.

Responses:

*INVCU* Invalid command - command unknown.

Example: TLN

*INVMS* Invalid command - message syntax error.

Example: RLN;

If no number is stored at the specified address nothing is returned for that address. The separator {sep} is a

<etb><sy><sy><stx>LSN<sp>

sequence for BISYNC format (the last LSN string terminates with per V.25 bis). For synchronous bit-oriented operation, each LSN string is treated as an individual message per V.25 bis.

All stored numbers are sent to the DTE as

LSNa;nn...n{sep}a;nn...n...

where *a* is the stored number address and *nn....n* is the number stored.

**Disregard Incoming Call DIC**

The command for disregarding an incoming call does not require parameters. If no call is incoming, the command is ignored.

Responses:

*VAL* Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

*INVCU* Invalid command - command unknown.

Example: TIC

*INVMS* Invalid command - message syntax error.

Example: SIC;

### **Connect Incoming Call CIC**

No parameters are required. If there is an incoming call, the modem immediately answers the call. If no call is incoming, the command is ignored.

Responses:

*VAL* Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

*INVCU* Invalid command - command unknown.

Example: TIC

*INVMS* Invalid command - message syntax error.

Example: SIC;

### **Redial Last Number CRR n**

The *CRR n* command redials the last number a maximum of n times. If no parameters are present, the modem redials once. Also, the maximum number of redials, the amount of time between redials, and other parameters may vary depending on application and national requirements if outside the U. S.

Responses:

Same as for the CRS command.

Failure response is

{sep}r;{call progress messages}...

where r is the recall count ( $1 \leq r \leq n$ ; 1,2,...,etc.), followed by a separator field and call progress messages (CFI XX, etc.). If the call fails to connect, this is repeated for the specified number of times.

**Link Number by Address PRL *a;b***

This command links the number at address *a* with the number at address *b*. The addresses are one digit decimal values. Linking numbers enables different numbers to be dialed if a call failure occurs.

Only forward linking to one other number is allowed, so address 1 can be linked to 4 to 8 to 9 etc.; however (using this example), if address 4 is dialed by a *CRS* command without connection it links forward to 8 then to 9.

If all these fail to connect, the autodialer will not back-link to address 1 unless circular linking is used. Numbers may be linked as 4 to 5 to 3; however, if address 3 is dialed, back-linking to 5 is not allowed.

If circular linking (1 to 8 to 7 to 1) is used, dialing is discontinued after the addressed number in the dial command has been dialed twice. If only one parameter follows the *PRL* command, the number at address *a* is unlinked from its forward link.

For example, if the link list 4 to 8 to 3 to 7 to 9 to 1 exists and *PRL 7* is received, 7 would be unlinked from 9, but not from 3. This would result in two link lists: 4 to 8 to 3 to 7 and 9 to 1.

Responses:

**VAL** Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

**INVCU** Invalid command - command unknown.

Example: TRL 1;5

**INVMS** Invalid command - message syntax error.

Examples: PRL;1;5  
PRL;

**INVPS** Invalid command - parameter syntax error.

Examples: PRL 1;5;  
PRL 1;0;0

PRL 1;  
PRL  
PRL 001;5

*INVPV* Invalid command - parameter value error.

Examples: PRL 1;Q

PRL Q;1

PRL 1;45 where only addresses  
01 - 09 are defined

*CFILD* Call failure - no connection from link list.

### **Request List of Linked Numbers RLL**

The request list of linked numbers command is an *RLL* with no parameters.

Responses:

*INVCU* Invalid command - command unknown.

Example: TLL

*INVMS* Invalid command - message syntax error.

Example: RLL;

*LSL* List linked numbers.

In all *LSL* examples, if no number is stored at the specified address no response is sent. The separator field for BISYNC is an

<etb><sp><sp><stx>LSL<sp>

The last *LSL* string ends with per V.25 bis. For synchronous bit oriented operation, each *LSL* string is treated as an individual message per V.25 bis. All linked numbers are sent to the DTE as

LSLa;l{sep}a;l

where *a* = stored address and *l* = link address.

**Request List of Version RLV**

The request list of version information command is an *RLV* with no parameters.

Responses:

*INVCU* Invalid command - command unknown.

Example: TLV

*INVMS* Invalid command - message syntax error.

Example: RLV;

**LSV** List version

The version information is sent to the DTE as

*LSV<sp>Sbbbbbb00scppddr / comment field*

where *bbbbbbb* is the board number, *s* is the series number, *cc* is the controller code revision, *pp* is the data pump code revision, *dd* is the board dash number, and *r* is the printed circuit board revision followed by a comment field.

**MODEM OPTIONS COMMAND PRO xxx;yy;0;0...**

The program options command is *PRO* followed by the starting register address (1 to 3 decimal digits), option count (1 or 2 decimal digits) and the data for each option (1 to 3 decimal digits per option). The Options section lists all available options with definitions, possible settings, and default values.

The modem must be able to accept 40 non-ignored characters besides the *PRO* command (leading zeros and semicolons are not considered ignored characters).

Responses:

**VAL** Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

*INVCU* Invalid command - command unknown.

Example: TRO 0;1;1

*INVMS* Invalid command - message syntax error.

Examples: PRO;0;1;1  
PRO;

*INVPS* Invalid command - parameter syntax error.

Examples: PRO 0;1;0;  
PRO 0;1;1;1  
PRO  
PRO 0;001;1

*INVPV* Invalid command - parameter value error.

Examples: PRO 0;1;Q  
PRO Q;1;1  
PRO 0;0;0  
PRO 68;1;0

when option 68 is undefined for the modem.

*INVPV<sp>xxx* Invalid command - parameter value error.

Examples: PRO 10;5;0;0;0;2;1

This invalid message can be returned when a block of options is being changed. The conditions for this invalid response are as follows:

- An undefined option number is specified. In the above example, if option 12 is undefined for a certain modem (and no other error conditions apply) options 10 and 11 would be changed as specified in the command message. The next option to be changed would be option 12. The modem would detect that this is an undefined option, stop execution of the command, and return an INVPV012 message. Options 10 and 11 would still be changed as commanded, options 13 and 14 would be unchanged.

- An out-of-range value for a particular option is specified. In the above example, if the fourth value in the option string is undefined or out-of-range for option 13 in a certain modem (and no other error conditions apply) options 10 through 12 would be changed as specified in the command message. The next option to be changed would be option 13. The modem would then detect that the value is undefined or out-of-range for that option, stop execution of the command, and return an INVPV013 message. Options 10 through 12 would still be changed as commanded; options 13 and 14 would be unchanged.

### **Save Current Settings PRK**

*PRK* saves option settings current.

Responses:

**VAL** Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

**INVCU** Invalid command - command unknown.

Example: TRK

**INVMS** Invalid command - message syntax error.

Examples: PRK;0 PRK Q

### **Restore Factory Settings PRP *n***

*PRP n* restores current option settings to factory option set *n* where *n* is a 1 digit decimal number.

 **Note**

*Restoring a factory option set other than factory option 9 disables the V.25 synchronous dialer.*

If no parameter follows the command, the modem automatically selects factory option set 1.

Responses:

**VAL**      Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

**INVCU**    Invalid command - command unknown.

Example: TRP

**INVMS**    Invalid command - message syntax error.

Examples: PRP;1 PRP Q

**INVPS**    Invalid command - parameter syntax error.

Examples: PRP 1; PRP 1;1 PRP 001

**INVPV**    Invalid command - parameter value error.

Example: PRP 5

where factory default 5 is not defined for the modem.

Current modem factory options are 1 - 9.

### **Request List of Stored Options RLO xxx; yy**

The request list of stored options command is *RLO* followed by an optional 1 to 3 digit decimal address and a 1 or 2 digit decimal count. The Options section below lists all available options with definitions, possible settings, and default values.

Responses:

**INVCU**    Invalid command - command unknown.

Example: TLO 0;1

**INVMS**    Invalid command - message syntax error.

Examples: RLO;0;1

RLO Q;1

**INVPS**    Invalid command - parameter syntax error.

Examples: RLO 0;1;

RLO 0;1;4

RLO 0;001

*INVPV* Invalid command - parameter value error.

Examples: RLO 0;Q RLO 0;0 RLO999;45

*LSO* List stored options.

The separator {sep} for BISYNC is an

<etb><sp><sp><stx>LSO<sp>

sequence for the sync format (the last *LSO* string terminates with per V.25 bis). For synchronous bit oriented operation, each *LSO* string is treated as an individual message per V.25 bis.

If no parameters follow, all stored options are sent to the DTE as

LSOxxx;ooo{sep}xxx;ooo...

Each value must be padded with leading zeros so that each field has three characters. Option zero would be sent as

LSO000;000

If only an address follows the command, the single requested option is sent to the DTE as

LSOxxx;ooo

If address and count follow the command, the requested count of options starting with the specified address are sent to the DTE as

LSOxxx;ooo{sep}xxx;ooo...

## OPTIONS

This section lists the options for the V.25 bis autodialer. These options can be changed using the *PRO* command or listed using the *RLO* command.

000-001: Not applicable

002: Intermediate call progress messages  
0 - Disable  
1 - Enable  
Default value = 0

003: Blind dial  
0 - Disable  
1 - Enable  
Default value = 0

004-006: Not applicable

007: Long space disconnect  
0 - Disable  
1 - Enable  
Default value = 1

008-019: Not applicable

020: Programmable / permissive operation  
0 - Permissive  
1 - Programmable  
Default value = 0

021-022: Not applicable

023-049: Reserved for future use

050: Mode  
0 - 2-wire dial-up operation (PSTN)  
1 - 4-wire leased line operation  
2 - 2-wire leased line operation  
Default value = 0

051: Primary transmit / receive rate  
(See Rate Select section below.)  
Default value = 54 (28800 bps)  
000-006: Not applicable  
007: 1200 bps  
008: 2400 bps  
009-033: Not applicable  
034: 4800 bps  
035: 9600 bps uncoded  
036: 9600 bps  
037-045: Not applicable  
046: 7200 bps  
047: 12,000 bps  
048: 14,400 bps  
049: 16,800 bps  
050: 19,200 bps  
051: 21,600 bps  
052: 24,000 bps  
053: 26,400 bps  
054: 28,800 bps  
055-999: Reserved for future use

052-054: Not applicable

055: Transmit clock  
0 - Internal  
1 - External  
2 - Receive (slave)  
Default value = 0

056: Leased line transmit level -  
Transmit level (0 through -30 dBm)  
(- {decimal} dBm)  
Default value = 0

057-062: Not applicable

063: Autoanswer  
0 - Disable  
1 - Enable (answer after 1 to 255 rings)  
Default value = 1

- 064: Line current disconnect  
0 - Off  
1 - Short (8 ms)  
2 - Long (90 ms)  
Default value = 2
- 065-075: Not applicable
- 076: Speaker control  
0 - Off  
1 - On  
2 - N/A  
3 - N/A  
4 - On until CD  
5 - N/A  
6 - Off while dialing  
Default value = 4
- 077: Speaker volume  
0 - Low  
1 - Medium  
2 - High  
Default value = 1
- 078-084: Not applicable
- 085: Constant carrier RTS/CTS delay  
0 to 250 ms  
Must be set in increments of 10 ms:  
10, 20, 30 . . . 250  
Default value = 0
- 086: Not applicable
- 087: DTR dropout timer  
0 to 255 in 10 ms increments  
DTR must turn off for this length of  
time to be recognized.  
Default value = 5 (50 ms)
- 088: Not applicable

- 089: Pause in dial string  
0 - Invalid  
1 to 255 seconds  
Default value = 2
- 090: Carriage return character  
(13 decimal is ASCII and EBCDIC default)
- 091: Line feed character  
(10 decimal is ASCII default;  
37 decimal is EBCDIC default)
- 092: Guard tone  
0 = None  
1 = 550 Hz  
2 = 1800 Hz  
Default value = 0
- 093: Carrier detect delay  
0 - Off 1 to 255 in increments of 10 ms  
Default value = 6 (60 ms)
- 094: Loss of carrier disconnect  
0 - Off 1 to 255 in 100 ms increments  
Default value = 14 (1.4 sec)
- 095: DTR dial address  
Stored telephone number address to dial  
on DTR off-to-on transition  
Default value = 1
- 096: DTR dial  
0 - Disable  
1 - Enable  
2 - N/A  
Default value = 0
- 097: Not applicable

- 098: Call timeout  
0 - Off  
1-255 sec  
Default value = 30 sec
- 099-102: Not applicable
- 103: Signal quality retrain  
0 - Disable  
1 - Send training sequence on poor quality  
Default value = 1
- 104-106: Not applicable
- 107-110: Reserved for future use
- 111: Modulation mode  
000: Automode  
001: V.21  
002: B103  
003: Reserved  
004: Reserved  
005: V.22  
006: V.22 bis  
007: V.27 ter  
008: Reserved  
009: V.29  
010: Reserved  
011: V.33  
012: V.32 bis  
013: V.34 (V.Fast)
- 112 V.34 Select Threshold  
000: Low  
001: Medium  
002: High
- 113 V.34 Asymmetric bit rates  
000: Disabled  
001: Enabled

114 - 899: Reserved for future use

900-902: Not applicable

903: Bilateral loop  
0 - Disable  
1 - Enable  
Default value = 0

If enabled and a test is commanded, bilateral loop is defined as follows:

<b>Test Commanded</b>	<b>Bilateral Loop</b>
-----------------------	-----------------------

Loop 1	Loop 2
Loop 2	Loop 1
Loop 3	Loop 4
Loop 4	Loop 3

Loop definitions are per CCITT V.54.

904: DTE commanded remote digital loopback  
0 - Disable  
1 - Enable  
Default value = 0

905: DTE commanded local analog loopback  
0 - Disable  
1 - Enable  
Default value = 0

906: Remote commanded test  
0 - Disable  
1 - Enable  
Default value = 1

907: Test timer  
0 - Until DTR drops  
TTT - 1 to 255 sec  
Default value = 0

908: Not applicable

909-999: Reserved for future use

## **Chapter 12**

# **Maintenance**

### **Warning**

*Disconnect power before performing maintenance.*

*Although dangerous voltage levels are not exposed, disconnecting power will ensure an electric shock hazard is not present.*

### **GENERAL**

The modem contains no internal electronic components that can be serviced or replaced by the user. Repairs should not be attempted by the user.

### **FUSE**

If a fuse fails, replace it with one of equal rating. Repeated failure indicates a more serious problem.

### **MAINTENANCE**

The modem provides maintenance free service. Periodically it is necessary to remove dust that has collected on internal components. Remove dust with a soft bristle brush and low pressure air or vacuum.

Before attempting diagnostic tests, check that all connectors and plugs are firmly inserted. The test procedures will identify the faulty component in a bad communications link.

If the unit appears faulty, contact the Motorola Field Service Department at 1-800-221-4380 for service and assistance. Do not return the unit without prior instructions.



## **Appendix A Specifications**

### **Size**

Width      7.0 inches (17.78 cm)  
Depth      10.5 inches (26.67 cm)  
Height      2.25 inches (5.72 cm)  
Weight      2 lbs. 13 oz. (1.28 kg)

Front Panel 32 ASCII character LCD

### **Environmental Conditions**

Temperature:

Operation +32° F to +122° F  
(0° C to +50° C)

Storage -40° F to +158° F  
(-40° C to +70° C)

Humidity: 0 to 95% relative humidity: noncondensing

### **Power Requirements**

The modem can be ordered for operation with one of three power input options.

Voltage:      115 Vac ±10%; 50-60 Hz,  
                  230 Vac ±10%; 50–60 Hz, or  
                  12 to 60 Vdc

Power consumption: 14 watts

### **Telephone Line**

Balanced 600 ohm type 3002 or equivalent 16 dB nominal loss,  
frequency translation up to ±10 Hz

### **Digital Interface**

Conforms to EIA-232D and CCITT V.24

### **Modem Data Rates**

300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, and 28800 bps.

### **Fax Rates**

14400, 12000, 9600, 7200, 4800, 2400, 1200, and 300 bps

### **Modulations**

V.34, V.32, V.22, V.21, V.27 bis, V.29, Bell 103, V.17, V.33, V.22 bis, V.32 bis

### **Fax Modulation**

<b>Modulation</b>	<b>Speed</b>
V.21 channel 2	300 bps
V.27 ter	2400 bps
V.27 ter	4800 bps
V.29	7200 bps
V.17	7200 bps
V.17	7200 bps with short train
V.29	9600 bps
V.17	9600 bps
V.17	9600 bps with short train
V.17	12000 bps
V.17	12000 bps with short train
V.17	14400 bps
V.17	14400 bps with short train

### **Internal Transmit Clock Frequency**

Selected bit rate  $\pm$  0.01%

### **External Transmit Clock Frequency**

Selected bit rate  $\pm$  0.01%

### **Transmit Output Level**

0 to -30 dBm, selectable; PSTN operation is programmable or permissive.

**Operation**

4-wire, full-duplex, leased (private) line;  
2-wire, full-duplex, leased (private) line or PSTN

**Carrier Detect Level**

Dynamic to -43 dBm

**Telco Connection**

8-pin modular jack, dial and private lines

**Testing**

511 PN pattern (per V.52) V.54 remote loopback control

**Line Equalization**

Automatic adaptive

**RTS/CTS Delay**

From  $0 \pm 2$  ms to  $90 \pm 2$  ms, user selectable in 10 ms increments  
(The default is 0 ms.)

**Link Layer Protocols**

V.42/V.42 bis error correction and compression protocol  
MNP levels 2-5 error correction and compression protocol

*Specifications*

---

## **Appendix B** **Phone Jack Descriptions**

### **LINE PIN FUNCTIONS**

The 8-pin LINE jack connects to the PSTN dial-up lines. Pin Functions are:

<b>Pin</b>	<b>Function</b>
1, 2	Not used
3 MI	Switch hook on exclusion key telephone not used in some systems
4 R	Rings side of telephone line
5 T	Tip side of telephone line
6 MIC	Switch hook on exclusion key telephone
7 PR	Data jack program position
8 PC	To data jack program resistor

### **AUX PIN FUNCTIONS**

The 8-pin AUX jack allows a standard telephone or a leased line to be connected to the modem. The pin functions for this jack are:

<b>Pin</b>	<b>Function</b>
1, 2	Transmit pair - 4-wire leased line or Tx and Rx for 2-wire leased line
4, 5	Ring and tip (respectively) of telephone line for a telephone
7, 8	Receive pair - 4-wire leased line

*Phone Jack Descriptions*

---

## Appendix C Strap Options

### STRAP OPTION SELECTION

Modem configuration is controlled by front panel pushbuttons and the LCD, AT or V.25 bis commands, and hardware option straps located on the pc board. Normally straps do not have to be changed. If a change is required, remote the modem cover to access the option straps. The strap diagrams on the following pages indicate the factory settings.

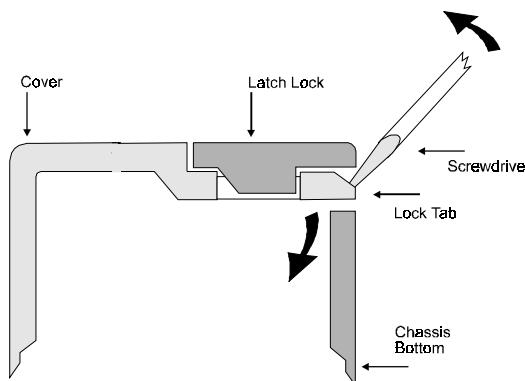
### Removing the Cover



#### Warning

*Disconnect ac power before removing the cover. Although dangerous voltage levels are not exposed, disconnecting power ensures an electrical shock hazard is not present.*

Place the unit on its side on a flat surface. To disengage the lock prong from the lock clip insert a medium size flat screwdriver blade in one of the latch slots. DO NOT PUSH the screwdriver but lightly pry the handle away from the unit as illustrated in Figure C-1. Assist removal by pushing the cover from the chassis with your fingers on the unit rear edges. Repeat this procedure with the remaining three latch slots.



**Figure C-1 Cover Removal**

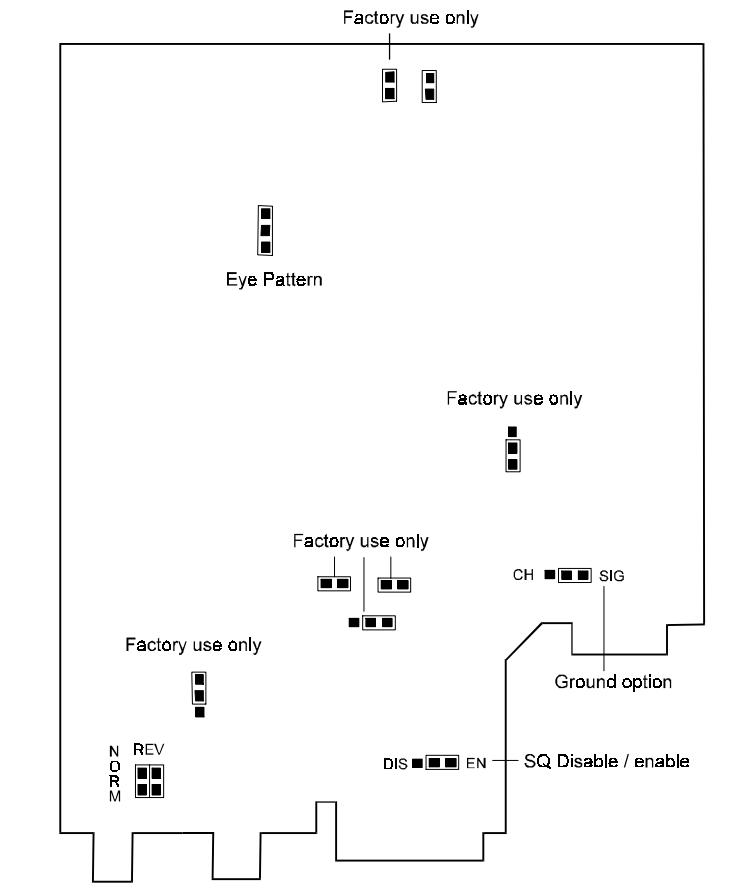
## *Strap Options*

---

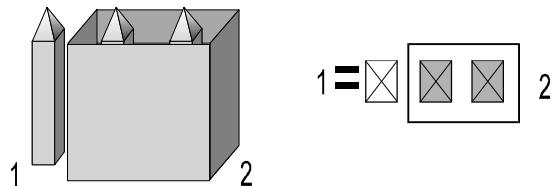
Figure C-2 shows strap locations and Figure C-3 shows typical strap configurations.

To replace the cover align the lock clips, rear guide grooves, and front lock tabs. Press the cover in place until the lock clips engage the lock prongs.

---



***Figure C-2 Strap Locations***



**Figure C-3 Typical Strap Configuration**

## HARDWARE STRAPS

### Tip and Ring Polarity

Some telephones are tip and ring polarity sensitive. If a dial tone is detected after dialing, reverse these two straps.

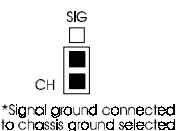


\*Normal tip and ring connection

Reverse tip and ring connection

### Ground Option Strap

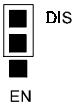
Signal ground is normally connected to chassis ground. If interference exists, isolate signal ground from chassis ground.



\*factory setting

### **QM Disable Option**

When enabled, the Quality Monitor (QM) output is connected to the EIA-232 (pin 11) interface. Disabling it disconnects the QM output. Refer to Chapter 4 and Table 2-1 for more QM information.



\*QM output (disabled) not connected to  
EIA-232 interface

### **QM Normal/Inverted**

This strap selects normal or inverted QM output.



\*QM output is normal  
(QM signal going high indicates poor signal quality)

\**factory setting*

## Appendix D

# Fault Isolation Procedure

### **FAULT ISOLATION PROCEDURE**

This diagnostic test procedure and the indicator lights built into the modem allow a rapid check of the terminals, modems, and telephone line interface. This procedure can be used to verify normal system operation and to isolate faulty equipment in case of failure.

Ensure the units are turned on and remote loops are enabled at both sites before starting the fault isolation procedure.



#### **Note**

*In some cases the observer must distinguish between rapid LED blinking and steady on in tests.*

### **Telephone Interface**

1. Connect the modem to the dial-in line via the LINE jack on the back panel.
2. If the dial line is installed with a standard permissive data jack, connect a standard telephone to the AUX jack on the back panel of the modem and use the standard telephone procedure.

If the dial line is installed with an exclusion key telephone wired for data set controls the line, connect an exclusion key telephone to the RJ36X jack and use the exclusion key phone procedure.

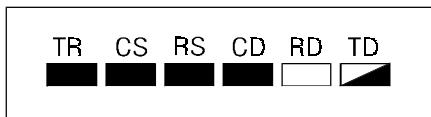
### **Standard Phone**

1. Configure the modem to V.34 28800 IDLE mode by pressing the TALK/ DATA button, and then lift the receiver. No dial tone is heard. Press the TALK/DATA button to display V.34 IDLE and wait for dial tone.
2. Dial out; the phone should operate normally.

## **MODEM AND TELEPHONE LINE CHECK**

### **Step 1**

- a. Configure the modem for LOCAL ANALOG LOOP WITH TEST PATTERN. This terminates the local modem telephone lines into 600 ohms and connects the local modem transmit output amplifier back to its own receiver through the AGC. Transmit input data from the terminal is inhibited and is substituted with a V.52 test pattern.
- b. This test checks operation of the local modem modulator and demodulator circuitry and should be attempted at both local and remote sites if operators are available.
- c. When random errors are present, the TEST PATTERN ERRORS display counts receive errors.
- d. If the circuitry is working properly, the front panel indicators show the following:

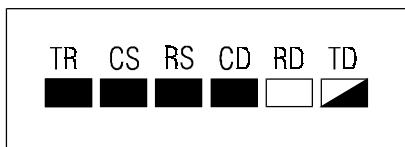


- e. Configure the modem for LOCAL ANALOG LOOP to switch the transmitter back to its normal data input.
- f. If the transmit data input is in a mark hold condition, both the TD and RD indicators should remain off.
- g. If the transmit data input is in a space hold condition, both the TD and RD indicators should come on. All other indicators should remain the same.
- h. If the indicators are correct, the modem is probably operating correctly.
- i. If the preceding tests were not successful, call Technical Services.

## Step 2

This step determines the performance of the local and remote modems and the telephone circuits. It also determines each modem's ability to receive a transmitted signal from the other site, properly equalize and decode the signal and then loop this regenerated signal into the transmitter for transmission back to the other modem. This test applies to both leased line and dial line operation.

- a. Configure the local modem for REMOTE DIGITAL LOOP WITH TEST PATTERN. This signals the remote modem to go into digital loop. The remote modem receives and then retransmits the data back to the local mode. If the digital bilateral loop is enabled at the remote, the remote DTE is looped back to itself.
- b. An alternative to the above procedure is to request the operator at the remote modem to configure his modem for LOCAL DIGITAL LOOP. Configure the local modem for TEST PATTERN. The remote modem receives and retransmits the data back to the local modem.
- c. The TEST PATTERN ERRORS display will count received errors.
- d. At the local modem, the indicators should be:



- e. To further test the modem and communications link, reverse the system loopback. First exit the existing loopback test. Reverse the roles of the local and remote modems and repeat step two.



**Note**

*If the bilateral digital loop is enabled at the local modem, the DTE interface is looped to itself and permits the DTE to check the interface circuitry as well as itself.*

## Appendix E

# Command Index and Defaults

### GENERAL

This reference guide provides asynchronous command characters and their meanings. Pages listed provide initial information on the commands.

S-registers are listed as a cross reference.

**Table E-1. AT Commands**

Command	Page	S-Reg	Description
AT	5-3		Attention code - command prefix
A/	5-5		Repeat last command
+++	5-21	S2, S12	Escape sequence (pause, + + +, pause)
A	5-17		Answer
D	5-13, 9-4		Dial
T	5-14	S14	Tone dial *
P		S14	Pulse dial
,		S8	Long pause (2 sec or S8 value)
W	5-15	S7	Wait for 2nd dial tone (S7 value)
!			Flash switchboard
R			Switch to answer mode after dialing
;			Return to command mode after dialing
@	5-16		Wait for 5 seconds of silence
Sn			Dial stored command line
E	5-21	S14	Local character echo off
E1			Local character echo on *
F	5-22		Not supported - returns ERROR
F1			Disables online character echo

\*factory default



### Note

The \* in the command is part of the command; the \* in the description indicates the default.

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
H	5-22		Hang up †
H1			Forces modem off hook †
H2		S14	Set H command to V.32 * †
H3			Set H command to fast †
I	5-23		Request product code
I1			Request EPROM CRC value
I3			Request product version
I4			Request capability code
I5			Disconnect reason
L or L1			Speaker volume low
L2			Speaker volume medium*
L3			Speaker volume high
M		S22	Speaker off
M1			Speaker off when carrier is present
M2			Speaker always on
M3			Speaker off when dialing and carrier is present
O	5-24		Restore data mode (after escape) †
O1			Retrain and restores data mode (after escape) †
Q	5-7	S14	Response displays on *
Q1			Response displays off
Q2			Response displays on in originate mode only
Sn?	10-3		Read value in register <i>n</i> (decimal)
Sn? <sup>^</sup>			Read value in register <i>n</i> (hexadecimal)
Sn=v			Set <i>v</i> (value) in register <i>n</i> (decimal)
Sn=v <sup>^</sup>			Set <i>v</i> (value) in register <i>n</i> (hexadecimal)
Sn.#=v	10-4		Set single bit value in register <i>n</i> , # = bit position 0-7, <i>v</i> = bit value 1 or 0
V	5-6	S14	Response codes
V1			Response messages *

\*factory default

† cannot be executed from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
W	5-7		Negotiation display disabled *
W1			Negotiation display enabled
W2			Displays DCE link rate
X		S22	CONNECT (code 1), for all speeds, no dial tone or busy signal detection
X1			Appropriate connect codes for rate, no dial tone detection
X2			Wait for dial tone (appropriate connect codes)
X3			Detect busy signal (appropriate connect codes)
X4			Wait for dial tone, detect busy signal (appropriate connect codes) *
Y	5-24	S21	Long space disconnect disabled
Y1			Long space disconnect enabled *
Z	5-41		Reset to user option set #1 †
Z1			Reset to user option set #2 †
&C	5-18	S21	DCD always on *
&C1			DCD on while carrier is present
&C2			DCD off 5 seconds after disconnect
&C3			DCD follows remote RTS
&D	5-19	S21	DTR ignored *
&D1			DTR recalls command mode
&D2			DTR disconnects
&D3			DTR disconnects and resets modem to stored configuration
&F or &F1	5-40		Restore factory configuration 1 * †
&F2			Restore factory configuration 2 †
&F3			Restore factory configuration 3 †
&F4			Restore factory configuration 4 †
&F5			Restore factory configuration 5 †
&F6			Restore factory configuration 6 †

\*factory default

† cannot be executed from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
&F7	5-40		Restore factory configuration 7 †
&F8			Restore factory configuration 8 †
&F9			Restore factory configuration 9 †
&G	5-24	S23	No guard tone *
&G1			550 Hz tone
&G2			1800 Hz tone
&L	5-36	S27	Dial line * †
&L1		S32	Leased line 2-wire †
&L2			Leased line 4-wire †
&M	5-25	S27	Asynchronous dial / asynchronous data *
&M1			Asynchronous dial / synchronous data
&M2			Dials stored number when DTR off / on transition is detected / synchronous data
&M3			Manual dial / synchronous data
&M4		S30	V.25 bis autodialer with BISYNC protocol / synchronous data
&M5			V.25 bis autodialer with SDLC protocol / synchronous data
&M6			V.25 bis async dial / sync data
&P	5-26	S22	39/61 pulse make / break ratio *
&P1			33/67 pulse make / break ratio
&R	5-20	S21	CTS normal operating state
&R1			CTS forced on *
&R2		S72	CTS follows DCD
&R9			CTS equals RTS
&S	5-18	S21	DSR always on *
&S1			DSR on when ready to accept data
&S2			DSR off for 5 seconds after disconnect
&S3			DSR follows off hook (OH)
&T	5-44, 7-2		Terminate current test †
&T1	7-3		Initiate analog loopback †

\*factory default

† cannot be executed from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
&T3	7-5		Initiate digital loopback †
&T4	7-6	S23	Grant remote commanded digital loopback * †
&T5		S23	Denies remote commanded digital loopback †
&T6	7-7		Initiate remote digital loopback †
&T7			Initiate self test remote digital loopback †
&T8	7-4		Initiate self test analog loopback †
&V	5-41		View configuration profiles *
&V1			Display received signal status
&V2			Display active profile
&W	5-39		Store current configuration to user option set #1 *
&W1			Store current configuration to user option set #2
&X	5-26	S27	Internal clock *
&X1			External clock
&X2			Receive clock
&Y	5-40		Powerup with user option set #1 *
&Y1			Powerup with user option set #2
&Y?			Display powerup option set
&Zn	5-41		Store dial string
%A	6-5	S64	Disable auto-reliable fallback character *
%An			Set auto-reliable fallback character to <i>n</i> ( <i>n</i> = ASCII 1-127) †
%B	5-28	S69	Use DTE speed
%B1			300 bps max
%B2			1200 bps max
%B3			2400 bps max
%B4			4800 bps max
%B5			9600 bps uncoded max
%B6			9600 bps max
%B7			7200 bps max

\*factory default

† cannot be executed from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
%B8	5-28		12000 bps max
%B9			14400 bps max
%B10			Reserved
%B11			16800 bps max
%B12			19200 bps max
%B13			21600 bps max
%B14			24000 bps max
%B15			26400 bps max
%B16			28800 bps max *
%C	6-11	S56	Compression disabled
%C1			Compression enabled on transmit and receive data *
%C2			Compression enabled on transmit data only
%C3			Compression enabled on receive data only
%D	6-4	S62	Disable disconnect buffer delay *
%Dn			Set disconnect buffer delay in seconds n (n = 1-255)
%E	5-29	S60	Disable auto retrain
%E1			Enable auto retrain *
%L		S81	Disabled
%L1			Disabled *
%L2			1200 bps min
%L3			2400 bps min
%L4			4800 bps min
%L5			9600 bps uncoded min
%L6			9600 bps min
%L7			7200 bps min
%L8			12000 bps min
%L9			14400 bps min
%L10			Reserved
%L11			16800 bps min
%L12			19200 bps min

\* factory defaulted from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
%L13	5-29		21600 bps min
%L14			24000 bps min
%L15			26400 bps min
%L16			28800 bps min
%P=	5-43		Sets remote configuration security code to value entered after equal sign (0-99999999)
%P=D			Disabled
%P?			Displays remote configuration security code of local modem
%P=(blank)			Clears the security code*
%R	5-30	S53	Disable automatic rate adaption *
%R1			Enable automatic rate adaption low BER
%R2			Enable automatic rate adaption medium BER
%R3			Enable automatic rate adaption using high BER
%T	7-8		Transmit test pattern †
%T=	5-44		Followed by a remote configuration security code, establishes remote configuration †
%V	5-31		Display product revision level
%Z	5-32		Permissive (RJ11) * †
%Z1			Programmable (RJ45) †
\A	6-10	S63	Maximum block size of 64 characters
\A1			Maximum block size of 128 characters
\A2			Maximum block size of 192 characters
\A3			Maximum block size of 256 characters *
\B	6-11	S79	Transmit a break signal *
\Bn			Sets break length in 20 ms increments, $n=1-255$ , default is 35 (700 ms)
\C		S60	Disable auto-reliable buffer *

\* factory default

† cannot be executed from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
\C1	6-11		Buffer data for 4 seconds or 200 characters
\G	6-8	S54	Disable modem port flow control *
\G1			Enable modem port XON/XOFF flow control
\J	6-4	S72	Disable slaved DTE/DCE speed * (constant speed DTE on)
\J1			Enable slaved DTE/DCE speed (constant speed DTE off)
\Kn	6-8	S59	Selects action when encountering a break
\K			Break option 0
\K1			Break option 1
\K2			Break option 2
\K3			Break option 3
\K4			Break option 4
\K5			Break option 5 *
\M	6-4	S70	V.42 fast detect data sequence disabled
\M1			V.42 fast detect data sequence enabled *
\N	6-5	S70	Normal mode
\N1			Direct mode
\N2			MNP only
\N3			MNP or normal
\N4			LAPM only
\N5			LAPM with normal fallback
\N6			LAPM with MNP fallback
\N7			LAPM with MNP and normal fallback *
\Q	6-6	S54	Disable DTE flow control
\Q1			Enable DTE XON/XOFF flow control *
\Q2			Enable CTS flow control to the DTE
\Q3			Enables bilateral CTS/RTS flow control
\Q4			Disable DCE flow control
\Q5			Enable DCE XON/XOFF flow control *
\Q6			Enable CTS flow control to the DTE

\* *factory default* from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
\Q7	6-6		Enable CTS flow control to the DTE
\R	5-19	S60	Ring indicate, blinks for ring and remains on for duration of call
\R1			Ring indicate, blinks for ring and turns off when call is answered *
\T	6-10	S58	Disable inactivity timer *
\Tn			Set inactivity timer to <i>n</i> ( <i>n</i> = 1-255 minutes)
\V	5-7	S60	Disable protocol result codes *
\V1			Enable protocol result codes
\X	6-7	S54	No XON/XOFF characters to remote DCE *
\X1			Pass XON/XOFF characters to remote DCE
*AU <i>n</i>	5-16		Dial number stored at location <i>n</i> upon transition of DTR in command mode ( <i>n</i> = 1-9)
*AS	5-27		Disable V.34 asymmetric bit rate
*AS1			Enable V.34 asymmetric bit rate
*CN <i>x,n</i>	5-41		Store phone number <i>n</i> in location <i>x</i> ( <i>x</i> = 1-9)
*DA	5-32		Switches modem to talk mode * †
*DA1			Switches modem to data mode †
*DB	5-37		Manual dial backup operation *
*DB1			Automatic dial backup operation
*DG	7-9	S34	Disables bilateral digital loop *
*DG1			Enables bilateral digital loop
*FB	5-21	S29	Ignore pin 23 *
*FB1			Pin 23 transition causes DTE speed fallback
*FT	5-32	S29	Disable fast train *
*FT1			Enable fast train
*IC	5-32		Disregard incoming call
*LA	7-9	S34	Ignore pin 18 *
*LA1			DTE commanded LAL enabled
*LB	5-37		Return to leased line from dial backup †
*LC	5-33	S32	Line current disconnect disabled

\* factory default

† cannot be executed from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
*LC1	5-33		Short (8 ms) line current disconnect
*LC2			Long (90 ms) line current disconnect*
*LD	5-37		Manual dial backup *
*MM	5-27		Automode (modulation)
*MM1			V.21
*MM2			Bell 103J
*MM3			Reserved
*MM4			Bell 212A
*MM5			V.22 bis
*MM6			V.27 bis 4-wire leased only
*MM7			Reserved
*MM8			V.29 4-wire leased only
*MM9			Reserved
*MM10			V.33 4-wire leased only
*MM11			V.32 bis
*MM12			V.34
*ND	5-41		Displays the nine stored numbers
*NT	5-33	S29	AT command set disabled
*NT1			AT command set enabled *
*OR	5-37	S14	Originate *
*OR1			Forced answer
*RC	5-9	S57	15 - 4800 bps, 18 - 9600 bps *
*RC1			11 - 4800 bps, 12 - 9600 bps
*RD	7-9	S34	Ignore pin 21 *
*RD1			DTE commanded RDL enabled
*RO	5-42	S29	Retain options at disconnect *
*RO1			Restore options at disconnect
*RR	5-31		Rate negotiate to 2400 †
*RR1			Rate negotiate to 4800 †
*RR2			Rate negotiate to 7200 †
*RR3			Rate negotiate to 9600 †

\*factory default

†cannot be executed from remote configuration mode

**Table E-1. AT Commands (Continued)**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
*RR4	5-31		Rate negotiate to 12000 †
*RR5			Rate negotiate to 14400 †
*RR6			Rate negotiate to 16800 †
*RR7			Rate negotiate to 19200 †
*RR8			Rate negotiate to 21600 †
*RR9			Rate negotiate to 24000 †
*RR10			Rate negotiate to 26400 †
*RR11			Rate negotiate to 28800 †
*TDn	5-33		Sets dial transmit level -10 to -30 dBm
*TH	5-26		Low rate selection threshold ( $10^{-6}$ BER)
*TH1			Medium rate selection threshold ( $10^{-4}$ BER)
*TH2			High rate selection threshold ( $10^{-2}$ BER)*
*TLn	5-37	S52	Sets leased line transmit level to $n$ where $n$ is a number between 0 and 30 corresponding to 0 to -30 db †
\$H	5-31		Online quick reference
\$V			Display product serial number

\*factory default

† cannot be executed from remote configuration mode

**Table E-2. Low Security Commands**

<b>Command</b>	<b>Page</b>	<b>S-Reg</b>	<b>Description</b>
\$S=x	8-3		Sets an empty password location to $x$
\$C=x,y			Changes either password where $x$ represents the old password and $y$ is the new one
\$C=x,-			Deletes password $x$ from memory
\$DR			Reset security
\$D=x			Disables security where $x$ is either password
\$D?	8-4		Displays the current status of security
\$E=x			Enables security where $x$ is either password
\$E?			Displays the current security status

**Table E-3. High Security Commands**

Command	Page	S-Reg	Description
\$Cn=m	8-8		Set user callback number. $n$ = user number and $m$ = the callback number
\$D	8-7		Disable security *
\$E?	8-10		Display current security status (enabled/disabled)
\$EH=pw	8-6		Enable security ( $pw$ = superuser password) †
\$F=pw\$pw	8-10		Reinitialize security *
\$IBn	8-11		Display user information for a block of up to ten valid users ( $n$ = first user number)
\$In			Display user information ( $n$ = user number)
\$Ln=m	8-8		Set security level for the user specified by $n$ ( $m$ = security level)
\$M	8-9		Display illegal attempts information
\$M*			Reset illegal attempts registers and restore all suspended users to normal status
\$Mn			Reset illegal attempts registers and restore suspended user $n$ to normal status
\$Pn=pw\$pw	8-7		Set user password; $n$ = user number and new password ( $n=0$ for superuser $pw$ = password)
\$Rn	8-10		Remove a user ( $n$ = user number)
\$S?			Display current user status (superuser / user)
\$W0	8-9		Disable user changes (password and callback number) †
\$W1			Enable user changes (password and callback number) †
\$W2	8-10		Enable remote superuser †
\$W?	8-9		Display user changes remote superuser option status
\$\$	8-11		Local logoff
\$n=pw			Local logon ( $n$ = user number and $pw$ = password)
\$S=pw			Request to enter superuser status ( $pw$ = password)

\* Only local superuser can execute command

† Only allowed in idle mode and local DTE

**Table E-4. Fax Commands**

Fax Command	Page	Description
+FCLASS=0	9-6	Service Class 0 (data modem) * ‡
+FCLASS=1		Service Class 1 (fax modem) ‡
+FCLASS?		Display current Service Class setting ‡
+FCLASS=?		Display available Service Class settings ‡
+FAA	9-10	Enables fax auto answer function

\* default

‡ Cannot executed from remote configuration

**Extended (Class 1) Commands Valid only in fax mode:****Table E-5. Commands Valid only in Fax Mode**

Command	Page	Description
+FTS=(Time)	9-6	Stop transmission and pause (10 ms intervals, 0-255) *
+FRS=(Time)	9-7	Waits for silence (10 ms intervals, 0-255) *
+FTM=(MOD)	9-8	Transmit data with (MOD) carrier *
+FRM=(MOD)		Receive data with (MOD) carrier *
+FTH=(MOD)		Transmit HDLC data with (MOD) carrier *
+FRH=(MOD)	9-9	Receive HDLC data with (MOD) carrier *

where the (MOD) parameter can be one of the following values:0.

Value	Modulation	Speed
3	V.21 channel 2	300 bps
24	V.27 ter	2400 bps
38	V.27 ter	4800 bps
72	V.29	7200 bps
73	V.17	7200 bps
74	V.17	7200 bps with short train
96	V.29	9600 bps
97	V.17	9600 bps
98	V.17	9600 bps with short train
121	V.17	12000 bps
122	V.17	12000 bps with short train
145	V.17	14400 bps
146	V.17	14400 bps with short train

\* cannot be executed from remote configuration

**Table E-5. Commands Valid only in Fax Mode (Continued)**

Command	Page	Description
+FTx=?	9-9	Check range for values supported where $x$ may be $M$ , $S$ , or $H$ . If $x$ is $M$ or $H$ , the modem returns 3, 24, 48, 72, 73, 96, 97, 98, 121, 122, 145, 146. If $x$ is $S$ , the modem returns 0-255.
+FCERROR		Carrier different from specified in +FRM or +FRH

## STATUS REGISTERS

**Table E-6. Status Registers**

S-Reg	RO/ RW	Page	Function	Default
S0	RW	10-5	Ring to answer	1
S1	RO		Ring count	
S2	RW		Escape sequence character	43 (+)
S3	RW		End-of-line character	13 (CR)
S4	RW	10-6	Line feed character	10 (LF)
S5	RW		Backspace character	8 (BS)
S6	RW		Pause before blind dialing	2 (2 sec)
S7	RW		Pause for carrier	30 (30 sec)
S8	RW		Pause for comma	2 (2 sec)
S9	RW		Carrier validation	6 (0.6 sec)
S10	RW	10-7	Loss carrier delay time	14 (1.4 sec)
S11	RO		DTMF tone duration	
S12	RW		Escape sequence pause	50 (1 sec)
S14	RW	10-8	Bit mapped	
S16	RO	10-9	System tests	
S18	RW		Test timer	0
S21	RW	10-10	Bit mapped	
S22	RW	10-11	Bit mapped	
S23	RW		Bit mapped	
S25	RW	10-12	DTR recognition time	5 (0.5 sec)
S26	RW		RTS/CTS delay	0
S27	RW		Bit mapped	

RO=Read only RW=Read or write

**Table E-6. Status Registers (Continued)**

S-Reg	RO/ RW	Page	Function	Default
S28	RW	10-13	Lookback timer	15 min
S29	RW		Bit mapped	
S30	RW	10-14	V.25 mode selection	
S32	RW		Bit mapped	
S34	RW	10-15	Bit mapped	
S35	RW		Default dial number	
S39	RW		Bit mapped	
S44	RW	10-16	DTE XON character	
S45	RW		DTE XOFF character	
S49	RW		DCE XON character	
S50	RW		DCE XOFF character	
S52	RW		Lease transmit level	0
S53	RW	10-17	Bit mapped	
S54	RW		Bit mapped	0
S56	RW	10-18	V.42 compression	
S57	RW		Bit mapped	0
S58	RW		Inactivity timer	0
S59	RW	10-19	MNP break control	5
S60	RW		Bit mapped	
S61	RO	10-20	DTE character size, parity	6
S62	RW		Disconnect buffer delay	0
S63	RW		Maximum protocol block size	255
S64	RW	10-21	Auto-reliable character	0
S67	RO		Link speed status	
S69	RW	10-22	Maximum DCE speed	
S70	RW		Protocol operating mode	1
S71	RO	10-23	Protocol operating mode status	
S72	RW	10-24	Bit mapped	
S73	RW		Password timeout security	
S74	RW		Callback delay	
S75	RW	10-25	Callback retry	

RO=Read only RW=Read or write

**Table E-6. Status Registers (Continued)**

S-Reg	RO/ RW	Page	Function	Default
S76	RW	10-25	Callback retry delay	
S77	RW		Lockout threshold	
S78	RW		Autocallback timer	30
S79	RW		Break length	35
S80	RO	10-26	Serial port speed	6
S81	RW	10-27	Minimum DCE rate	1
S82	RW		Bit mapped	
S88	RW	10-28	Modulation type	
S91	RW		Current modulation	
S95	RW	10-29	V.34 settings	
S96	RW		V.34 settings	

RO=Read only RW=Read or write

## V.25 bis DIALER COMMANDS

**Table E-7. V.25 bis Dialer Commands**

Synchronous Command	Page	Description
CIC	11-8	Connect incoming call command
CRN nn...n	11-5	Dial command (nn...n = number to be dialed)
0 - 9		DTMF and pulse digit
* #		DTMF digit
:		Wait for dial tone
W		Wait for second type of dial tone
>		Pause for 1 second
=		Pause for 3 seconds
<		Pause for programmed delay time
P		Pulse dial
T		Tone dial
&		Flash (go on hook) for 1/2 second
;		Parameter separator

**Table E-7. V.25 bis Dialer Commands (Continued)**

Synchronous Command	Page	Description
Space, dash, parenthesis, period		Clarity characters
CRR <i>n</i>	11-8	Redial the last number a maximum of <i>n</i> times
CRS <i>a</i>	11-6	Dial stored number command ( <i>a</i> = address)
DIC	11-7	Disregard incoming call command
PRK	11-13	Save current option settings
PRL <i>a;b</i>	11-9	Link number at address <i>a</i> with number at address <i>b</i>
PRN <i>a; nn...n</i>	11-6	Program number command ( <i>nn...n</i> = number to be dialed, <i>a</i> = address)
PRO <i>xxx;yy;0;0...</i>	11-11	Program options command ( <i>xxx</i> = register address, <i>yy</i> = option count)
PRP <i>n</i>	11-13	Restores current option settings to the factory defaults in default bank n (1-9)
RLL	11-10	Request list of linked numbers command
RLN	11-7	Request list of stored numbers command
RLO <i>xxx;yy</i>	11-14	Request list of stored options command ( <i>xxx</i> = register address, <i>yy</i> = option count)
RLV	11-11	Request list of version information command

**Table E-8. Response Messages**

Response Message	Meaning
CFIAB	Call failure - answer back tone but no connection
CFIDT	Call failure - no dial tone
CFIET	Call failure - reorder or busy
CFILD	Call failure - link list complete
CFINS	Call failure - number not stored
CFINT	Call failure - no answer back tone, no ringback
CFIRT	Call failure - timeout occurred
CNX @ 28800 bps	Intermediate call progress - connection made at 28800

**Table E-8. Response Messages (Continued)**

Response Message	Meaning
CNX @ 26400 bps	Intermediate call progress - connection made at 26400
CNX @ 24000 bps	Intermediate call progress - connection made at 24000
CNX @ 21600 bps	Intermediate call progress - connection made at 21600
CNX @ 19200 bps	Intermediate call progress - connection made at 19200
CNX @ 16800 bps	Intermediate call progress - connection made at 16800
CNX @ 14400 bps	Intermediate call progress - connection made at 14400
CNX @ 12000 bps	Intermediate call progress - connection made at 12000
CNX @ 9600 bps	Intermediate call progress - connection made at 9600
CNX @ 7200 bps	Intermediate call progress - connection made at 7200
CNX @ 4800 bps	Intermediate call progress - connection made at 4800
CNX @ 2400 bps	Intermediate call progress - connection made at 2400
CNX @ 1200 bps	Intermediate call progress - connection made at 1200
INC	Incoming ring detected
INVCU	Invalid command - command unknown
INVMS	Invalid command - message syntax error
INVPS	Invalid command - parameter syntax error
INPVV	Invalid command - parameter value error
VAL	Valid command received

## **FACTORY OPTION SETS**

### **FACTORY OPTION SET #1 (Asynchronous Dial-up with V.42bis Protocol) (AT&F or AT&F1)**

#### **• MODEM OPTIONS**

DCE rate - 28800  
Modulation automode  
V.34 rate threshold high  
V.34 asymmetric rate enabled  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Dial line  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

#### **• PROTOCOL OPTIONS**

LAPM protocol enabled  
MNP protocol enabled  
Protocol fallback enabled  
Data compression normal  
Constant DTE speed  
DTE flow control XON/XOFF  
DCE flow control XON/XOFF  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 5  
V.42 fast detect enabled

#### **• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

#### **• TEST OPTIONS**

Bilateral analog loop disabled  
Bilateral digital loop disabled  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

#### **• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 30 seconds  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

#### **• DTE OPTIONS**

Async data  
DTE rate - 9600  
8 bit, No parity  
Async controlled dialer  
AT command set enabled  
Ignores DTR  
DSR forced high  
DCD forced high  
CTS forced high  
DTE fallback disabled  
Options retained at disconnect

**FACTORY OPTION SET # 2  
(Asynchronous Dial-up without V.42bis Protocol) (AT&F2)**

**• MODEM OPTIONS**

DCE rate - 28800  
Modulation automode  
V.34 rate threshold low \*  
V.34 asymmetric rate enabled  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Dial line  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

**• PROTOCOL OPTIONS**

LAPM protocol disabled \*  
MNP protocol disabled \*  
Normal buffer mode \*  
Constant DTE speed  
DTE flow control disabled \*  
DCE flow control disabled \*  
XON/XOFF pass through disabled \*  
Inactivity timer off  
Break control 0 \*  
V.42 fast detect disabled \*

**• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

**• TEST OPTIONS**

Bilateral analog loop disabled  
Bilateral digital loop disabled  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

**• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 30 seconds  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

**• DTE OPTIONS**

Async data  
DTE rate - 9600  
8 bit, No parity  
Async controlled dialer  
AT command set enabled  
Ignores DTR  
DSR forced high  
DCD forced high  
CTS follows RTS \*  
DTE fallback disabled  
Options retained at disconnect

\* Indicates variation from factory option set #1

## **FACTORY OPTION SET #3 (Synchronous Dial-up) (AT&F3)**

### **• MODEM OPTIONS**

DCE rate - 28800  
Modulation automode  
V.34 rate threshold low \*  
V.34 asymmetric rate disabled \*  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Dial line  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

### **• PROTOCOL OPTIONS**

LAPM protocol disabled \*  
MNP protocol disabled \*  
Direct buffer mode \*  
DTE flow control disabled \*  
DCE flow control disabled \*  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 0 \*  
V.42 fast detect disabled \*

### **• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

### **• TEST OPTIONS**

Bilateral analog loop disabled  
Bilateral digital loop disabled  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

### **• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 30 seconds  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

### **• DTE OPTIONS**

Sync data \*  
Dial method manual \*  
AT command set disabled \*  
DTR disconnects \*  
DSR normal \*  
DCD normal \*  
CTS follows RTS \*  
RTS/CTS delay 0 ms \*  
DTE fallback disabled  
Options retained at disconnect

\* Indicates variation from factory option set #1

## **FACTORY OPTION SET # 4 (Synchronous 4-wire Leased Line) (AT&F4)**

### **• MODEM OPTIONS**

DCE rate - 28800  
V.34 modulation \*  
V.34 rate threshold low \*  
V.34 asymmetric rate enabled  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Leased line \*  
4-wire \*  
Transmit level - 0 dBm \*  
Dial backup manual \*  
Lookback timer - 15 min \*  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

### **• PROTOCOL OPTIONS**

LAPM protocol disabled \*  
MNP protocol disabled \*  
Direct buffer mode \*  
DTE flow control disabled \*  
DCE flow control disabled \*  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 0 \*  
V.42 fast detect disabled \*

### **• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

### **• TEST OPTIONS**

Bilateral analog loop enabled \*  
Bilateral digital loop enabled \*  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

### **• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 60 seconds \*  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

### **• DTE OPTIONS**

Sync data \*  
AT command set disabled \*  
Ignores DTR  
DSR normal \*  
DCD normal \*  
CTS follows RTS \*  
RTS/CTS delay 0 ms \*  
DTE fallback disabled  
Options retained at disconnect

\* Indicates variation from factory option set #1

## **FACTORY OPTION SET #5**

**(Asynchronous 4-wire Leased Line with V.42bis Protocol) (AT&F5)**

### **• MODEM OPTIONS**

DCE rate - 28800  
V.34 modulation \*  
V.34 rate threshold high  
V.34 asymmetric rate enabled  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Leased line, 4-wire \*  
Transmit level - 0 dBm \*  
Dial backup manual \*  
Lookback timer - 15 min \*  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

### **• PROTOCOL OPTIONS**

LAPM protocol enabled  
MNP protocol disabled \*  
Protocol fallback disabled \*  
Data compression normal  
Constant DTE speed  
DTE flow control XON/XOFF  
DCE flow control XON/XOFF  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 5  
V.42 fast detect enabled

### **• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

### **• TEST OPTIONS**

Bilateral analog loop disabled  
Bilateral digital loop disabled  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

### **• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 30 seconds  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

### **• DTE OPTIONS**

Async data  
DTE rate - 9600  
8 bit, No parity  
AT command set enabled  
Ignores DTR  
DSR forced high  
DCD forced high  
CTS forced high  
DTE fallback disabled  
Options retained at disconnect

\* Indicates variation from factory option set #1

**FACTORY OPTION SET # 6**  
**(Asynchronous 4-wire Leased Line without V.42 Bis Protocol) (AT&F6)**

**• MODEM OPTIONS**

DCE rate - 28800  
V.34 modulation \*  
V.34 rate threshold low \*  
V.34 asymmetric rate enabled  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Leased line, 4-wire \*  
Transmit level - 0 dBm\*  
Dial backup manual \*  
Lookback timer - 15 min \*  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

**• PROTOCOL OPTIONS**

LAPM protocol disabled \*  
MNP protocol disabled \*  
Normal buffer mode  
  
Constant DTE speed  
DTE flow control disabled \*  
DCE flow control disabled \*  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 0 \*  
V.42 fast detect enabled

**• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

**• TEST OPTIONS**

Bilateral analog loop disabled  
Bilateral digital loop disabled  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

**• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 30 seconds  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

**• DTE OPTIONS**

Async data  
DTE rate - 9600  
8 bit, No parity  
AT command set enabled  
Ignores DTR  
DSR forced high  
DCD forced high  
CTS forced high  
DTE fallback disabled  
Options retained at disconnect

\* Indicates variation from factory option set #1

**FACTORY OPTION SET # 7**  
**(Synchronous 2-wire Leased Line Normal Originate) (AT&F7)**

**• MODEM OPTIONS**

DCE rate - 28800  
V.34 modulation \*  
V.34 rate threshold low \*  
V.34 asymmetric rate disabled \*  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Leased line, 2-wire \*  
Transmit level - 0 dBm\*  
Dial backup manual \*  
Lookback timer - 15 min \*  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

**• TEST OPTIONS**

Bilateral analog loop disabled  
Bilateral digital loop disabled  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

**• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 60 seconds \*  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

**• PROTOCOL OPTIONS**

LAPM protocol disabled \*  
MNP protocol disabled \*  
Direct buffer mode \*  
DTE flow control disabled \*  
DCE flow control disabled \*  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 0 \*  
V.42 fast detect disabled \*

**• DTE OPTIONS**

Sync data \*  
AT command set disabled \*  
Ignores DTR  
DSR normal \*  
DCD normal \*  
CTS follows RTS \*  
RTS/CTS delay 0 ms \*  
DTE fallback disabled  
Options retained at disconnect

**• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

\* Indicates variation from factory option set #1

## **FACTORY OPTION SET # 8 (Synchronous 2-wire Leased Line Forced Answer) (AT&F8)**

### **• MODEM OPTIONS**

DCE rate - 28800  
V.34 modulation \*  
V.34 rate threshold low \*  
V.34 asymmetric rate disabled \*  
Forced answer \*  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Leased line, 2-wire \*  
Transmit level - 0 dBm\*  
Dial backup manual \*  
Lookback timer - 15 min \*  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

### **• PROTOCOL OPTIONS**

LAPM protocol disabled \*  
MNP protocol disabled \*  
Direct mode \*  
DTE flow control disabled \*  
DCE flow control disabled \*  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 0 \*  
V.42 fast detect disabled \*

### **• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

### **• TEST OPTIONS**

Bilateral analog loop enabled \*  
Bilateral digital loop enabled \*  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

### **• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 60 seconds \*  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

### **• DTE OPTIONS**

Sync data \*  
AT command set disabled \*  
Ignores DTR  
DSR normal \*  
DCD normal \*  
CTS follows RTS \*  
RTS/CST delay 0 ms \*  
DTE fallback disabled  
Options retained at disconnect

\* Indicates variation from factory option set #1

**FACTORY OPTION SET #9  
(Synchronous V.25bis Dialer) (AT&F9)**

**• MODEM OPTIONS**

DCE rate - 28800  
Modulation automode  
V.34 rate threshold low \*  
V.34 asymmetric rate disabled \*  
Normal originate  
Fast train disabled  
Auto retrain enabled  
Sq auto rate disabled  
Transmit clock internal  
Dial line  
Jack type RJ11 (permissive)  
Line current disconnect long  
Long space disconnect enabled  
V.22 guard tone disabled

**• PROTOCOL OPTIONS**

LAPM protocol disabled \*  
MNP protocol disabled \*  
Direct mode \*  
DTE flow control disabled \*  
DCE flow control disabled \*  
XON/XOFF pass through disabled  
Inactivity timer off  
Break control 0 \*  
V.42 fast detect disabled \*

**• SPEAKER OPTIONS**

Volume medium  
On until carrier detect

**• TEST OPTIONS**

Bilateral analog loop disabled  
Bilateral digital loop disabled  
DTE local test disabled  
DTE remote test disabled  
Remote commanded test enabled  
Test timeout off

**• DIAL LINE OPTIONS**

Tone dial  
Auto dial #1  
Wait for dial tone  
Wait delay 2 seconds  
Pause delay 2 seconds  
Call timeout 30 seconds  
Answer on 1 ring  
801 V.32 timeout long  
Autocallback disabled

**• DTE OPTIONS**

Sync data \*  
V.25 SDLC dialer \*  
Character type ASCII  
SDLC data format NRZ \*  
DTR disconnect \*  
DSR normal \*  
DCD normal \*  
CTS follows RTS \*  
RTS/CTS delay 0 ms \*  
RTS/CTS delay 0 ms \*  
DTE fallback disabled  
Options retained at disconnect

\* Indicates variation from factory option set #1



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